THREE ESSAYS ON GOVERNANCE STRUCTURE IN THE HOSPITAL INDUSTRY

by

LANCE DARSHANA KAUFMAN

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Student: Lance Darshana Kaufman

Title: Three Essays on Governance Structure in the Hospital Industry

This dissertation has been accepted and approved in partial fulfillment of the requirements for the Doctor of Philosophy degree in the Department of Economics by:

Dr. Wesley W. Wilson	Chair
Dr. Van Kolpin	Member
Dr. Benjamin Hansen	Member
Dr. Renee Irvin	Outside Member

and

Kimberly Andrews Espy	Vice President for Research & Innovation/Dean of the Graduate School

Original approval signatures are on file with the University of Oregon Graduate School.

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DISSERTATION ABSTRACT

Lance Darshana Kaufman

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Title: Three Essays on Governance Structure in the Hospital Industry

An important factor in the rise of health care costs is the structure and performance of health care markets. This is an area in which policy can be particularly effective. Health care markets are characterized by complex interactions between consumers, physicians, insurers, facilities, and government agencies. Physicians, insurers, and facilities operate under a mix of objectives and governance structures. The many varieties of objectives, and governance structures can be broadly categorized as for-profit, not-for-profit, and governmental.

In the three chapters that follow I construct a theoretical framework to analyze hospital behavior and use a 30 year panel of data on Californian hospitals to assess the validity of the models and to identify the impact of governance structure on behavior. Chapter II addresses firm objectives. I find that firms have a continuum of weighting allocations, with for-profit firms placing greater weight on profit, government firms placing greater weight on social objectives, and not-for-profit firms locating in a middle ground. All three types of governance structures display overlap in their objectives.

In Chapter III, I identify patterns in hospital entry and exit. Like most manufacturing industries, entering hospitals are significantly smaller than incumbent

hospitals and exiting hospitals are significantly smaller than surviving hospitals. The patterns of entry and exit for hospitals vary systematically with both governance structure and geographic diversification.

In Chapter IV, I develop a model of hospital entry that explains heterogeneous entry size and firm survival. I find entry size to be a relatively important factor in firm survival. In general entering on a larger scale increases the probability of survival. Despite this fact many firms enter relatively small. The model that I develop resolves small entry as a rational choice for uncertain firms.

CURRICULUM VITAE

NAME OF AUTHOR: Lance Darshana Kaufman

GRADUATE AND UNDERGRADUATE SCHOOLS ATTENDED:

University of Oregon, Eugene
University of Alaska, Anchorage

DEGREES AWARDED:

Doctor of Philosophy, Economics, 2013, University of Oregon
Master of Science, Economics, 2009, University of Oregon
Bachelor of Business Administration, Economics, 2005, University of Alaska, Anchorage
Associate of Applied Science, Culinary Arts, 2002, University of Alaska, Anchorage
Certificate, Massage Therapy, 2001, University of Alaska, Anchorage

AREAS OF SPECIAL INTEREST:

Governance Structure and Firm Behavior
Industrial Organization of Hospital Markets

PROFESSIONAL EXPERIENCE:

Utility Analyst, Oregon Public Utility Commission, 2013 to present
Graduate Teaching Fellow, Economics, University of Oregon, 2007 to present
Research Assistant, Impact Assessment, 2005 to 2007
Research Assistant, Economics, University of Alaska, Anchorage, 2004 to 2008

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CHAPTER I

INTRODUCTION

Over the last 30 years consistently rising costs have made health care one of the most important economic issues in the modern US economy. In 2009 the US spent approximately $2.5 trillion dollars, or 17.3% of GDP on health care. The share of GDP allocated to health care is projected to continue growing over the next 10 to 20 years as the population ages and costs continue to increase.

An important factor in the rise of health care costs is the structure and performance of health care markets. This is an area in which policy can be particularly effective. Health care markets are characterized by complex interactions between consumers, physicians, insurers, facilities and government agencies. Physicians, insurers, and facilities operate under a mix of objectives and governance structures. The many varieties of objectives and governance structures can be broadly categorized as for-profit, not-for-profit, and governmental.

The complex mix of agents and objectives make the health care market a unique and challenging field of exploration for economists. Many of the traditional industrial organization models and findings do not readily transfer. A significant body of research exists on health care markets, however there continues to be disagreement on how governance structure and firm objective affect firm behavior and market outcomes. My research adds to the discussion by providing a systematic, theoretical and empirical analysis of the relationship between governance structure and hospitals.

An important motivation for this research is the steady and constant increase in healthcare costs over the last 60 years. Figure 1. charts the slow rise of health care costs over time. This research does not provide direct solutions to rising health care costs. Instead it develops a body of knowledge regarding the structure and behavior of hospital firms.

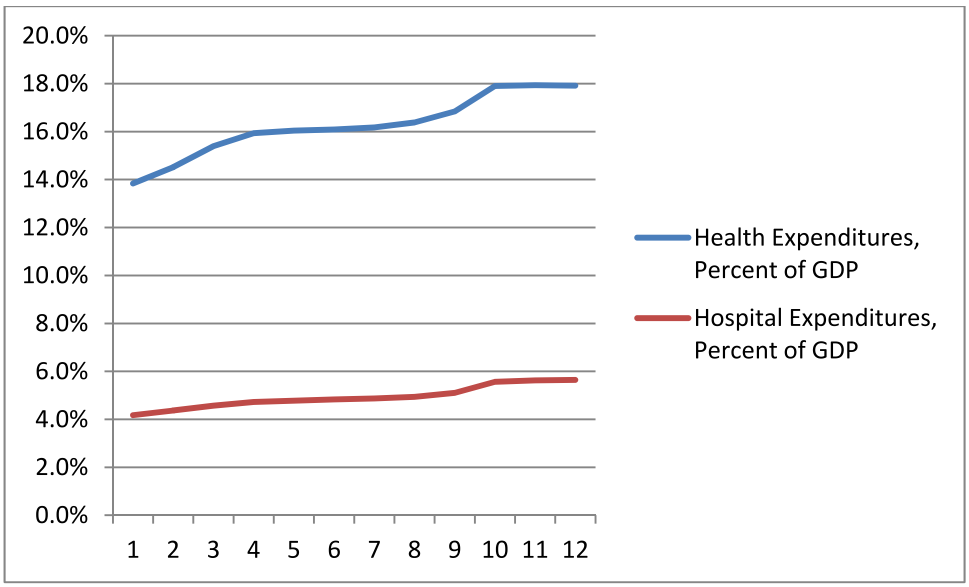

Figure 1. Spending as Percentage of GDP. Source: National Health Expenditure Data.

In the three chapters that follow, I construct a theoretical framework to analyze hospital behavior and use a 30 year panel of data on Californian hospitals to assess the validity of the models and to identify the impact of governance structure on behavior. Chapter II addresses firm objectives. In this chapter, I use pricing decisions to reveal the weight that firms place on profit and social benefit. I find that firms have a continuum of weighting allocations, with for-profit firms placing greater weight on profit, government firms placing greater weight on social objectives and not-for-profit firms locating in a middle ground. All three types of governance structures display overlap in their objectives.

In Chapter III, I identify patterns in hospital entry and exit. This is exploratory research intended to reveal the mechanisms underlying hospital behavior and identify fruitful avenues for further work. Chapter III establishes many informative patterns in entry and exit behavior. Among these is the existence of an important relationship between governance structure, multi-hospital systems and entry size. This finding motivates the survival analysis presented in Chapter IV.

In Chapter IV I develop a model of hospital entry that explains heterogeneous entry size and firm survival. I find entry size to be a relatively important factor in firm survival. In general entry on a larger scale increases the probability of survival. Despite this fact, many firms enter relatively small. The model that I develop resolves small entry as a rational choice for uncertain firms.

CHAPTER II

GOVERNANCE STRUCTURE AND FIRM OBJECTIVES: A STUDY OF FOR-PROFIT AND NOT-FOR-PROFIT HOSPITAL BEHAVIOR

The objective of not-for-profit firms cannot be clearly deduced from standard economic theory. Yet firm objectives and behavior are critical factors in both government policy and consumer behavior. This paper develops and estimates a model that allows firms to care for both private and public gains. Instrumental variable regressions of financial data for Californian hospitals indicates that not-for-profit hospitals price at a lower markup than for-profit hospitals, and church-controlled hospitals mark up less than regular not-for-profits.

Introduction

Standard economic theory assumes that firms maximize profits. The firm is treated as a black box that mechanically converts inputs into products for maximum profit. The theoretical and empirical justification for profit maximization assumes that those who control firms enjoy property rights over the profits of the firm. Remove this assumption, as is the case with not-for-profit firms, and the justification falls flat. This raises the question that Dennis Young vocalized in 1983, "If not for profit, for what?"

Approximately 1.4 million U. S. organizations voluntarily restrict their ability to distribute profits. These organizations constitute the not-for-profit sector of our economy and together account for 5.5% of GDP and 9% of employment in the United States [Roeger, Blackwood, and Pettijohn; 2012]. Yet, the existing economic literature does not provide a consistent and comprehensive theory of not-for-profit behavior. Most hypothesized objectives for not-for-profit reduce to maximizing social welfare, employee welfare, or board member welfare. However, in reality, most not-for-profit firms pursue all three objectives simultaneously [Steinberg, 2000]. Anecdotal evidence indicates that some not-for-profit firms are primarily profit driven and some are genuinely devoted to the public good [Silber, 2001].

In this paper, I provide a theoretical and empirical argument that not-for-profit firms have a distribution of objectives ranging from purely self-interest to purely public interest. My model of firm behavior allows the aggregation of these seemingly contrary objectives into a single objective function. Under this model firms that care for both social welfare and private well-being exert some but not all possible market power.

I frame the empirical model around the first-order conditions of a firm. The model is estimated with data from the California hospital market. The estimates reveal that not-for-profit firms are neither purely altruistic nor purely profit-seeking. Not-for-profit firms differ significantly from for profits in their pricing behavior. Furthermore, religious not-for-profits are significantly more altruistic than corporate not-for-profits.

The hospital market is an ideal market to test this model for several reasons. Hospitals represent an important industry in both the not-for-profit sector and the economy as a whole. Hospitals are often large firms with significant market power. Finally, the three major governance structures: for-profit, not-for-profit, and government, are all well represented in the hospital market.

Health care accounts for approximately 18% of U. S. GDP [National Healthcare Expenditure Data]. The treatment of health care is one of the most important tasks of modern government. Nearly half of all not-for-profit employment in the US involves health care. In comparison, the next largest field of not-for-profit employment, education, represents only 22%.

The importance of hospitals is reflected in both the health care and not-for-profit literature. However, this literature approaches the question of firm objective as black or white, with no provision for multiple objectives. This paper contributes to the existing literature by identifying the heterogeneity of not-for-profit firm objectives. Heterogeneity of firm objectives is important for policy, consumer, and donor decisions.

Previous literature on the objective of not-for-profit firms two dichotomous views of firms, as either profit-seeking in disguise or as altruistic entities. This research presents a model that unifies these views and an econometric method of estimating the value that firms place on each objective.

Hospital and Not-For-Profit Background

U. S. hospital expenditures in 2009 totaled $759.1 billion. This was 5% of GDP and 31% of all health care spending [National Healthcare Expenditure Data]. While health care is a growing field in economics, the structure and behavior of hospitals has witnessed relatively little research.

The health care market violates nearly every requirement for perfect competition. Asymmetric information, high search costs and cost sharing are particularly important in driving the hospital market away from competitive equilibrium [Dranove and Satterthwaite, 2000].

The majority of hospital services are paid through government programs and private insurers. Third-party payers often exert their monopsony power to negotiate prices. Town and Vistnes [2001] use proprietary HMO data to identify that hospitals' negotiated pricing agreements depend upon their relative value to the HMO's network. Third party payers also influence the consumer's choice of care [Pauly, 2000].

Medicare mandates the exact amount that may be charged for any particular diagnosis. Due in part to the inflexibility of Medicare pricing, many hospitals encourage "up coding" diagnosis with higher associated Medicare payments. Silverman and Skinner [2004] find significantly higher up coding in for profits compared to not-for-profits.

Hospital prices have historically been unclear. Many hospitals have over 20,000 prices, and a single procedure may consist of a large number of products and services. Further complicating matters is the common practice of price discrimination. A procedure with a list price of $30,000 is charged to Medicaid for $6,000 and somewhere in between for private insurance groups. Uninsured might receive the service for free or pay the full amount. Transparency has received attention recently. In 2006, the US department of Health and Human Services began an initiative to disclose Medicare payment information. In 2003, California mandated that all hospitals provide a list of all charges. However, comparison of hospitals remains difficult due to inconsistencies in service definitions and variations in discounts and contracts.

Hospital administrators have suggested that a more useful method of obtaining price information is to contact individual hospitals [Cutland, 2005]. However, a study sponsored by the California Health Care Foundation [DelPo, 2005] found that only 75.5% of inquiries resulted in an estimate, and many of the successful estimates required significant time and repeated inquiries. UC Davis Medical Center uses a sliding scale markup to set prices. Items which cost less than $40 are marked up 1300% while items which cost over $500 are marked up 250% [Lagnado, 2004].

One result of the high variance in price for a particular service is the prevalence of cost shifting from low generosity payers to high generosity payers [Dor and Farley, 1996] This suggests that while hospitals have restricted pricing powers, they can reduce quality for a given service. The existence of cost shifting suggests several important things. Consumers must be, to some extent, aware of varying levels of quality. Insurers must either be unaware of quality, or target quality through pricing decisions.

The public's subsidization of not-for-profits, in the form of tax breaks, donations of labor and time, and legal preferences, is based on the belief that the hospital is providing some charitable or public good beyond what a for profit firm would offer. The IRS requires that not-for-profit hospitals provide some form of community benefit IRS [Revenue Ruling 69-545, 1969-2 C.B. 117]. In recent years, however, the actions of some not-for-profit firms have caused the public to question their integrity and intentions. Excessive inefficiency, waste and embezzlement have lowered the public trust in not-for-profits [Silber, 2001].

In 2003, the General Accountability Office commissioned a study on uncompensated care provided by hospitals. In four out of five states studied, charity care as a percent of total care was slightly higher for not-for-profits than for profits. However, California not-for-profits actually provided less uncompensated care than for profits. In every state uncompensated care was concentrated in a small group of hospitals. The top quartile of Californian hospitals devoted 7.2% of expenses to uncompensated care while the bottom quartile devoted 1.4%. This suggests possible behavioral differences within not-for-profit hospitals.

Two types of information asymmetries are important in the hospital market. Medical providers are more knowledgeable than patients regarding possible treatments and outcomes. This results in over treatment or poor quality of treatment. In addition, both patients and providers know more about the benefits of treatment than insurers do. Medicare up coding is just one of many examples of how hospitals utilize information asymmetry.

Three bodies of literature are important to this study: theory of not-for-profits, hospital competition and mixed market oligopolies. The theories of not-for-profit firms inform my research in two ways. The motivation of not-for-profit entrepreneurs directly affects the firm's objective. The behavior of consumers and their preferences over firm type should be considered in any mixed firm competition.

Many neoclassical economists struggle to explain why not-for-profits are a useful firm structure. Hansmann [1980] suggests that the non-distribution constraint of not-for-profits remedies agency problems and asymmetric information. In the case of hospitals, the level and quality of care may be unobservable by donors and patients. If this is the case, the profit motive may induce hospitals to provide sub optimal levels of service and extract the cost savings as profit.

Ortmann and Schlesinger [1997] object to the acceptance of this trust hypothesis on the grounds that repetition makes firms care about their track record. The maintenance of this trust depends on the degree to which managers are allowed to extract non-monetary profits. Not-for-profit firms that succeed in developing trust create opportunities for rents through its exploitation. Historically, many firms violate the non-distribution constraint [Silber, 2001]. Weisbrod [1998] notes that the non-distribution constraint is costly to enforce. It is particularly difficult to identify the extraction of profits in small firms.

The non-distribution constraint may also function as a signal to stakeholders of the firms altruistic motives. Because of this signal consumers may be more tolerant of price discrimination by non profit firms [Hansmann, 1981].

The US government has sponsored several recent inquiries into the community benefit of hospitals. The Congressional Budget Office [CBO 2006] reports that there is little consensus on measures for community benefit. One of the most common measures, uncompensated care, is a poor measure because it does not distinguish between bad debt and service to the indigent. A result of the present study is that one of the more significant differences in cost allocation between for-profits and not-for-profits is cost allocation to billing and collections.

The CBO also found that not-for-profits were more likely to provide less profitable services. Such services include emergency room care, labor and delivery, intensive burn care, and high level trauma.

In 2006, the Government Accountability Office surveyed executive compensation at not-for-profit hospitals. This survey focused on governance structure, basis for compensation and internal controls. Not-for-profit hospital systems have similar governance structures and compensation policies. Executive compensation is often based on comparable markets and decided by committee; however, policies regarding employment perks such as entertainment and travel expenses varied considerably [GAO, 2006].

A GAO report from 2008 analyzed hospitals from 4 states and found that community benefit practices varied significantly by state and hospital size. This may be due, in part, to the fact that state tax exempt requirements vary substantially. Hospital specific definitions of community benefit lead to large variance in reported levels of community benefit [GAO, 2008].

Hospitals contribute to the community through uncompensated care, medical education, research and community programs. The IRS [2007] estimates that these respectively account for 56%, 23%, 15%, and 6% of community benefit expenditure by not-for-profit hospitals. However, hospitals may provide additional indirect benefit to the community through lower prices and provision of unprofitable services.

Not-for-profits often provide some public good. Weisbrod [1975] suggests that non-profits may provide public goods when both for profit and government sector fail to provide adequate levels. Market failures are relatively well understood. Government failures occur when a subgroup of the population has a marginal utility for the public good that exceeds that demanded by the general populace. For example, the wealthy may have a higher willingness to pay for the care of the indigent than the poor.

Cynics suggest that not-for-profits are simply wolves in sheep's clothing. Not-for-profit firms may enjoy both demand and cost advantages over for profits. Firms find ways of avoiding the non-distribution constraint through perks, salaries and self-dealing [Pauly and Redisch, 1973]. Tax advantages, preferential government and legal treatment and greater consumer demand give not-for-profit firms competitive advantages

The entrepreneur is likely guided by a mixture of motivations. Young [1983] identifies various intrinsic motivations of the entrepreneur. These motivations play an important role in firm structure and organizational values. Stakeholder theory suggests that organizational behavior is influenced not just by the entrepreneur, but by all stakeholders of a firm. The degree of power which consumers, payers, workers, managers, board members, donors and suppliers have determines to a large degree the behavior of the firm. This lends credence to my earlier observation that subgroups of not-for-profits may have different objectives.

The hospital literature generally defines the hospital market as a differentiated oligopoly. Hospitals compete on the basis of price, quality, services and location. The standard method of defining price is as average revenue per discharge [Keelera and Zwanzigerc, 1999, Lynk and Neumann, 1999, Lynk, 1995, Dranove and Ludwick, 1999].

This definition is imperfect because it ignores variation in severity of diagnosis and quality of treatment [Dranove and Ludwick, 1999].

The theoretical effect of regulated pricing [Dor and Farley, 1996] and competition [to Ma and Burgess, 1993, Brekke et al., 2006, Lyon, 1999] is relatively well accepted, and the general agreement is that competition enhances quality. However, empirical research presents strong evidence both for [Kessler and McClellan, 2000] and against [Propper et al., 2008] this statement. Propper et al. [2008] suggests that unobserved quality is reduced, while observed quality increases with competition. The heterogeneity of not-for-profit firm objectives is consistent with these mixed results.

Town and Vistnes [2001] find that HMOs base contracting decisions on hospital facilities, services and location. The consumer often values proximity, but is willing to trade off proximity for perceived quality.

The mixed oligopoly literature consists mainly of game theoretic approaches to competition between public and private firms. The original purpose of the literature was to examine the welfare consequences of state owned firms competing in the market place with private enterprise. More specifically, it asks when the existence of a public firm can return oligopoly markets to the socially efficient level of production [de Fraja and Delbono, 1990]. With the decline of state owned industries in the 80s and 90s, this literature lost its original purpose. However, it still serves as a useful guide to understanding how not-for-profit firms may operate.

The hospital market most closely resembles the Hotelling-type models of Matsumura and Matsushima [2003, 2004], Cremer et al. [1991]. Matsumura and Matsushima [2004] identifies a pattern that is particularly interesting in its application to hospitals.

The hospital industry is one of the more substantial segments of our economy. However, the behavior of hospitals is still poorly understood. The health literature does not have a consistent explanation of hospital competition and the not-for-profit literature disagrees upon the purpose and objectives of not-for-profit firms. The next section proposes a model that unites these two literatures and explains their contrary findings.

A Model of the Hospital Industry

Consumers' decisions to consume a hospital service depends on the extent to which the service improves their health, the costs of the service, and the side benefits of consuming the service. The degree to which hospital service can improve health depends on individual and hospital specific factors.

Current health status is one of the most important factors affecting the health outcomes of hospital care. An individual's behavior before and after hospital service will affect the health outcomes of the hospital service. Quality of care varies significantly between hospitals. Qualitative factors include cleanliness, staff ability and workload, and information management practices. The match between types of hospital services and health issues also affects outcomes.

The costs of service depend on type of insurance, hospital prices, distance to hospital, and type, length, and quantity of service. The opportunity cost of service can be thought of as the health benefit of alternate hospitals and or procedures. A portion of a hospital's expenses may not significantly influence health outcomes. For example, landscaping, architectural embellishments, and entertainment services are usually used to increase consumer's enjoyment of treatment rather than health outcomes.

Individuals maximize utility by choosing among all available hospitals. The quantity demanded for a hospital depends on the characteristics of all the other hospitals. The quantity an individual demands from hospital h therefore depends on individual characteristicsI_h, the characteristics of all hospitals H and prices of all hospitals P. This suggests hospitals face the following inverse demand curve

$$P_h^* = p(Q, H, I_h)$$

Where P_h is the price of hospital h, Q is a vector of quantities for hospitals in the market, I is a vector of population characteristics, and H is a set of vectors of hospital characteristics for each hospital in the market.

This research provides both for-profit and not-for-profit firms the ability to care about private profit and social welfare. Many firms are observed to provide charitable services to the community. While this can be claimed to be a strategic choice to maximize long run firm value, economists have identified cases where shareholder preferences are not congruent with the assumption of pure profit maximization [Benninga and Muller, 1979, Jensen and John B. Long, 1972]. In addition to the shareholder theory of the firm, many corporations, such as Google and eBay, follow a stakeholder management system [R. Edward Freeman, 2004]. According to Freeman, stakeholder theory suggests that firm objective functions include non financial arguments.

Not-for-profit firms that wish to expand operations must either price above marginal cost or petition donors and granters for funds. In addition to seeking profits to fuel growth, many not-for-profits actually behave as for-profits in disguise. Examples exist across all industries in the not-for-profit sector of not-for-profit firms distributing profits in hidden ways. Young [1983] conducted extensive case studies of entrepreneurs and found that the objectives that a firm pursues are closely related to the preferences of the entrepreneur directing the firm. Young's finding suggests that firms seek to maximize an objective function that includes other arguments in addition to profit. Thus, firms maximize a utility function of the form

$$U = U(\pi, X).$$

Where π is firm profit and X is a vector of characteristics regarding the state of the world. If markets are perfect maximizing any objective function is equivalent to maximizing profit. However, if profit maximization results in deadweight loss through market power or externalities maximizing profits may result in an inferior outcome for the firm. It is impractical to model all characteristics that a firm could have preferences over. Three factors seem particularly relevant to hospitals: social welfare, quantity of output, and reputation. Social welfare is a relevant argument because hospitals, particularly not-for-profit and government hospitals, are thought to play an important role in the welfare of the communities. Individuals who work at hospitals often place value on helping people. Administrators may be more concerned about the quantity of individuals served. This would suggest that nonprofit firms cross subsidize to achieve a quantity greater quantity of service.

In this paper I assume that firms have preferences over profit and market surplus alone.

$$U = U(\pi_h, MS)$$

where

$$\pi_h = P_h Q_h - C(H_h Q_h)$$

$$MS = \sum_h P_h(Q, H, I) - C_h(H_h, Q_h)$$

with first order conditions

$$\frac{\partial U}{\partial \pi}\frac{d\pi}{dQ_h} + \frac{\partial U}{\partial MS}\frac{dMS}{dQ_h} = 0$$

If the solution is not a corner solution, the marginal utility of profit with respect to quantity is equal to the marginal utility of Social Welfare with respect to quantity.

For example, consider the simple case of a single firm with a single product, linear demand and linear cost:

$$U = U(\pi_h, MS) = \alpha\pi_h + (1 - \alpha)MS$$

$$P = a - bQ$$

$$C = cQ$$

$$\pi = PQ - cQ$$

$$MS = (a - c)Q^* - \frac{b}{2}Q^{*2}$$

The first-order condition for utility maximization is:

$$a - c - (1 + \alpha)bQ = 0$$

and the price quantity solution is

$$Q^* = \frac{a - c}{(1 + \alpha)b}$$

$$P^* = \frac{\alpha a + c}{1 + \alpha}$$

The standard assumption for for-profit firms is that firms maximize profit. This would correspond to $\alpha = 1$ and I would have monopoly pricing. The pure not-for-profit, social welfare maximizing firm would correspond to $\alpha = 0$. This results in competitive equilibrium.

Rewriting the first order condition and substituting in price gives

$$P = c + \alpha bQ$$

This pricing relation is equivalent to the oligopoly pricing relation frequently used to estimate the markup ratio, with the weight placed on profit being equivalent to the markup ratio. As the firm becomes more concerned about social welfare, the markup decreases and the market becomes more competitive.

Data Sources, Variables, and Descriptions

In this study, I estimate the influence of ownership on hospital pricing decisions. The purpose of this research is to determine how firm objectives differ across government, for profit and not-for-profit hospitals.

The primary source of the hospital data is the Office of Statewide Health Planning and Development (OSHPD). OSHPD conducts an annual financial survey of all acute care hospitals licensed in the state of California. The survey began in 1976 and has been conducted every year since. The survey identifies ownership type, hospital utilization and capacity, revenue, expenses, and balance sheet activity.

The endogenous variables used in this study are price and quantity. Hospitals provide a large variety of services, and the price of any individual service varies with the severity of the case, the method of payment, and outcomes of negotiations between the payer and the hospital. I follow the previous literature and construct price as average revenue per patient [Town and Vistnes, 2001]. Quantity is defined as total patient census days. A patient census day is a unit of measure denoting service to a single inpatient between the hours of two consecutive census-taking hours.

The exogenous variables are patient census days, hospital discharges, capacity, wages, per capita personal income, population and insurance level. Patient census days, hospital discharges, capacity and wages are reported for each hospital service. Sixty hospital services are reported. Few hospitals provided all Sixty services. I focus on general acute surgery because it is provided by the majority of hospitals and constitutes a significant portion of hospital revenues.

Table 1 contains the means and standard errors for the data. Two sided t-tests indicate that means of most variables for not-for-profits are significantly different than both for-profit and government hospitals.

Table 1: Variable Means and Standard Errors

	Not-For-Profit		For-Profit		Government	
Variable	Mean	SD	Mean	SE	Mean	SE
Price	706.7	9.8	643.3	13.1	598.2	17.3
Quantity	24797	493	13202	402	17850	1114
Population	3.2	0.10	5.2	0.17	1.2	0.08
Income	17.1	0.12	16.8	0.13	15.0	0.18
Capacity	132.5	2.41	80.6	1.86	93.5	5.42
Residual Quantity	591062	19378	991213	3828	317881	24138
Expense Per Unit	198.9	2.59	191.7	7.40	208.4	4.56
Wage:						
Management	19.7	0.10	18.5	0.17	18.2	0.21
Registered Nurse	16.7	0.09	15.4	0.12	15.2	0.13
Vocational Nurse	10.4	0.10	9.8	0.08	9.5	0.09
Aides	7.0	0.04	6.5	0.05	6.4	0.08

Tables 2 and 3 provide the distribution of hospital type and ownership. The distribution of ownership type varies by type of care. Not-for-profits account for 80 of 81 short term childrens hospitals but none of the 16 long term childrens hospitals are not-for-profit. Nearly 76% of observations are short term general care hospitals. Because psychiatric and other specialty hospitals likely have different operating characteristics, I restrict the data to short term general care hospitals.

Hospital observations range from 1997 to 2005. The number of licensed hospitals in California fluctuates around 350 before 2003 and drops to 320 after 2003.

Table 2: Primary Type of Care		
	Frequency	Proportion (%)
Long-Term Children	16	0.40
Long-Term General	189	4.69
Long-Term Psychiatric	61	1.51
Long-Term Specialty	83	2.06
Short-Term Children	81	2.01
Short-Term General	3,045	75.48
Short-Term Psychiatric	397	9.84
Short-Term Specialty	162	4.01
Total	4,034	100

Table 3: Hospital Governance Structure		
	Frequency	Proportion (%)
Church	365	9.05
Nonprofit Corp.	1,628	40.36
Nonprofit Other	134	3.32
City	9	0.22
City/County	42	1.04
County	278	6.89
District	413	10.24
State	91	2.26
Investor, Corp.	978	24.24
Investor, Partnership	87	2.16
Investor, Individual	9	.22
Total	4,034	100

This continues a downward trend documented by Shuffler et al. (2001). The drop was due primarily to a large number of for-profit corporation closures in 2003. The type of care for hospitals that closed was representative of the population.

The report period for the survey years is the hospitals fiscal year, with 6.9% of the observations reporting data for less than a full year, 92.4% reporting a full year and 0.7% of observations reporting for more than 365 days. An observation might not report a full year due to accounting changes, startups and closures. I exclude observations that report less or more than a full year.

My restrictions reduce the sample from 4051 to 3045 observations. The t-tests indicate significant differences between excluded and included data for all variables except price, population and income.

Of hospitals reporting a full year, 42.4% use a fiscal year beginning January 1, and 42.5% use a fiscal year beginning July 1 with the remainder distributed across the other 10 months. The BEA provides annual county level estimates of personal income and population. I constructed a weighted of county personal income and population for each hospital year. For observations beginning in the first 15 days of the month, I used the entire beginning month in the weight. For those beginning after the first 15 days of the month I used the entire ending month in the weight.

A cursory examination of the data reveals large and significant differences in the characteristics of for-profit and not-for-profit hospitals. The fact that not-for-profit hospitals tend to be larger than for-profit hospitals and operate in smaller markets suggests that they have greater market power than for-profits. This observation is critical in the interpretation of the empirical results. It identifies that relatively lower markups for not-for-profit firms is not due to lower market power. Not-for-profits have greater capacity and wages. This suggests a smaller profit motive. These observations are consistent with for profits being more motivated by profit and not-for-profits being more motivated by social welfare.

Empirical Applications

The empirical work seeks to determine whether the marginal rate of substitution between profit and welfare varies systematically with governance structure. The empirical model below modifies the model presented in section 3. The empirical model was estimated and the results are presented.

Empirical Model

I estimate two models. In the first case I assume linear demand and constant marginal cost with a demand function given by:

$$Q_{it} = \alpha_0 + \alpha_1 P_{it} + \alpha_2 X_{it} + \alpha_3 R_{it} + \epsilon_{it}$$

where Q_{it} is the quantity demanded from hospital i in year t, P_{it} is the price of hospital service, X_{it} is a vector of hospital and population characteristics that shift demand and R_{it} is the residual demand in the hospital's market. Constant marginal cost gives rise to the pricing relation given by:

$$P_{it} = \beta_0 + \beta_1 W + \alpha_1 \theta Q_{it} + \varepsilon_{it}$$

with W represents wage and θ represents the firm markup.

In the second model, I relax the assumption of constant returns to scale. However, with equation (4) θ is not identified. To resolve this, I use the demand equation

$$Q_{it} = \alpha_0 + \alpha_1 P_{it} + \alpha_2 P_{it} X_{it} + \alpha_3 R_{it} + \epsilon_{it}$$

with the pricing relation

$$P_{it} = \beta_0 + \beta_1 W + \beta_2 Q_{it} + \alpha_1 \theta X_{it} Q_{it} + \varepsilon_{it}$$

If every firm has monopoly power in their market, the estimate for θ can be interpreted as an estimate of the weight that the firm gives to social welfare in its objective function.

Results

The models were estimated for general acute surgery.[1] General acute surgery accounts for 47.2% of total census days in the median hospital. Quantity is defined as total patient census days.[2] Price is defined as average total revenue per patient census day. The model was estimated using two stage least squares regression. Table 4

[1] Also referred to as Unspecified General Acute Care (GAC); i.e., beds not designated as perinatal, pediatric, ICU, CCU, acute respiratory, burn center, ICNN, or acute rehabilitation.

[2] A patient census day is the number of days that inpatients (excluding newborns in the nursery) are hospitalized. The day of admission, but not the day of discharge, is counted as a patient day. If both admission and discharge occur the same day, the day is counted as one patient day.

provides the estimation results for the demand equation (4) in columns 1-3 and (6) in column 4. Price is instrumented with direct per unit expense. In column 4 per unit expense interacted with income provides the second instrument. This interaction is used to identify the scale parameter.

Table 4: Demand Equation Estimates

	Basic (1)	Hospital Fixed Effects (2)	All Demand Shifters (3)	DRTS (4)
Price	-31.122	-15.309	-20.721	-117.289
	(2.17)**	(2.74)***	(1.92)*	(2.33)**
Residual Quantity	0.017	0.001	-0.001	0.02
	(6.48)***	(-0.96)	(-0.85)	(4.08)***
Year	2607.518	1541.944	2232.847	3827.586
	(2.90)***	(4.27)***	(2.72)***	(2.30)**
County Population	-2.884	-0.024	-0.347	-3.502
	(4.89)***	(-0.12)	(-1.37)	(2.96)***
Per Capita Income			-339.246	1.396
			(-1.64)	(2.72)***
Health Insurance			-3719.712	
			(-1.13)	
Age			116.954	
			(-0.26)	
Price*Income				0.239
				(2.29)**
Observations	2766	2766	2044	2766
Governance Dummies	No	No	Yes	Yes
Firm Dummies	No	Yes	Yes	No
R-squared		0.96	0.95	
F	25.3	142.24	99.14	14.56

Absolute value of t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

In all specifications for demand, price is negative and statistically significant. Column 1 is a basic estimate of demand, and includes a time trend, county population as a demand shifter and residual quantity as a proxy for health characteristics of the county. Column 2 adds firm level fixed effects. This accounts for variations in demand due to both firm characteristics and unobserved population characteristics. Firm fixed effects greatly enhance the accuracy of the price estimate.

Column 3 introduces for-profit and not-for-profit dummies as well as additional demand shifters for county income, age, and percent insured. The governance dummies indicate that government hospitals generate a larger quantity than nonprofit and for profit hospitals. Due to small samples and confidentiality restrictions health insurance data from some counties are not present. This restricts the sample size from 2766 to 2044. The direct effect of health insurance should be to increase demand through moral hazard, a reduction in the marginal price of health care. However, insurance is also correlated with wealthier populations that have healthier lifestyles. The positive age coefficient is consistent with the fact that the age distribution of hospital admissions is skewed toward the elderly. The lack of significance of this variable is likely due to the method of linear interpolation of missing census years.

The model estimated in Column 4 interacts price with per capita income. Price is often a signal of quality. For individuals with high incomes, the signaling effect of price leads to higher demand. In column 1-3, $\partial q/\partial p$ is constant and equal to the price coefficient. However, in column 4 $\partial q/\partial p = \alpha 1 + \alpha 2Xit$ Under the estimates of column 4, $\partial q/\partial p$ has a mean of −94.05 and a standard deviation of 6.46.

Both pricing relations instrument quantity with income and population. Table 5 contains the estimates for the constant returns to scale pricing relation (5). The estimates for θ are calibrated with the point estimate for ∂q/∂p from Table 5 column 1. Because the pricing relation is homogeneous of degree one in markup, the alternate estimates for ∂q/∂p would proportionally scale the estimates for θs but would have no effect on any other estimates.

Table 5: Pricing Relation Estimates Constant Returns to Scale

	(1)	(2)	(3)	(4)
Quantity*Gov	-15.24978	-14.62734	-10.8927	-16.49466
θ_{Gov}	0.49	0.47	0.35	0.53
	(15.84)***	(11.88)	(10.87)***	(11.90)***
Quantity*FP				
θ_{FP}	0.83	0.8	0.46	1.01
	(12.09)***	(7.69)	(5.87)***	(8.30)***
Quantity*NP				
θ_{NP}	0.55	0.51	0.27	0.52
	(16.68)***	(10.08)	(6.47)***	(8.45)***
Direct Expence Per Unit	0.7	0.62	0.11	0.19
	(11.88)***	(9.26)	(-1.51)	(2.16)**
Management			3.93	-6.25
			(-1.28)	(-1.59)
Registered Nurse			38.49	34.11
			(8.63)***	(5.99)***
Vocational Nurse			0.04	5.58
			(-0.01)	(-1.28)
Aides			43.81	-16.6
			(4.80)***	(-1.17)
Observations	2766	2044	1759	1759
			<	
Pr[NP = Gov]	0.04**	0.24	0.001***	0.61
	<	<	<	<
Pr[NP = FP]	0.001***	0.001***	0.001***	0.001***
F	105.28	60.16	119.47	23.34

Absolute value of t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
Markup is calculated by dividing the slope estimate for quantity by the slope estimate for price.

Table 6 provides estimates for a specification that allows for decreasing returns to scale in the pricing relation. Table 2.6 markup estimates are the coefficients on the partial of the vectors $(\alpha_1 + \alpha_2 X_{it})Q_{it}G_i$ where G_i is a governance dummy matrix. While the estimates of this pricing relation vary with the estimate of $\partial q/\partial p$, the estimates are robust to different demand specifications.

Table 6: Pricing Relation Estimates Non-constant Returns to Scale

	(1)	(2)	(3)
Quantity	0.005	0.024	0.052
	(3.08)***	(4.43)***	(3.92)***
Income*Quantity*Gov	-4.808849	-13.722813	-10.204143
θ_{Gov}	0.041	0.117	0.087
	(5.57)***	(6.56)***	(2.66)***
Income*Quantity*FP	-7.858363	-17.710639	-19.235396
θ_{FP}	0.067	0.151	0.164
	(7.51)***	(5.96)***	(4.82)***
Income*Quantity*NP	-3.870537	-13.253657	-9.852276
θ_{NP}	0.033	0.113	0.084
	(5.37)***	(5.85)***	(2.79)***
Direct Expence Per Unit	0.24	0.104	0.146
	(3.58)***	(1.06)	(-1.05)
Management	2.441	-11.206	-24.743
	(-0.98)	(2.05)**	(3.20)***
Registered Nurse	29.647	32.901	27.185
	(7.75)***	(5.81)***	(3.22)***
Vocational Nurse	1.962	6.164	11.993
	(-0.58)	(-1.17)	(1.68)*
Aides	24.264	8.716	-17.074
	(2.93)***	(-0.65)	(-0.87)
Capacity		-7.347	-11.765
		(5.14)***	(5.75)***
	No	No	Yes
Observations	2307	2307	2307
Pr[NP = Gov]	0.06	0.58	0.75
Pr[NP = FP]	< 0.001***	< 0.001***	< 0.001***
F	143.19	57.76	6.71

Absolute value of t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
Markup is calculated by dividing the slope estimate for income*quantity by the slope estimate for price.

The F tests for equality of not-for-profit and for profit markups find statistically significant difference at the 1% level in all 7 specifications. Under columns 1 and 3 of table 5 and column 1 of table 6 not-for-profit and government markups are significantly different. Not-for-profits do not exert market power to the same extent as for-profits, however they do not display the behavior of a purely social welfare maximizing firm. The data indicate that not-for-profit firms tend to locate in less competitive markets. Therefore the lower markup of not-for-profit hospitals is not due to an inability to affect prices, but rather an intentional choice not to.

To test the hypothesis that, within the designation of not-for-profit, firms behave differently, I modify the specification to allow θ to vary within not-for-profit firms. The results from these estimations are presented in table 7. Hospitals controlled by churches have a significantly smaller markup compared to hospitals controlled by not-for-profit corporations. This is consistent with my model. If an entrepreneur wished to found a not-for-profit with the intention of extracting profits, he or she would choose to organize outside of the church framework.

Conclusions and Caveats

This paper proposed a model of homogeneous firm objectives. This model was tested by examining the supply and demand for general acute surgery in Californian hospitals between 1997 and 2005. The empirical results in this paper support the hypothesis that not-for-profit firms have both a welfare maximizing motive and a profit-seeking motive. Furthermore, some not-for-profits place a greater weight on social welfare than others. As a group, church-based not-for-profits have a lower markup ratio than corporate not-for-profits.

Table 7: Markup Estimates By Type of Not-For-Profit

	(1)	(2)
θ_{Gov}	0.2	0.32
	(10.85)***	(12.96)***
θ_{FP}	0.28	0.71
	(5.84)***	(9.97)***
$\theta_{NP\ Church}$	0.18	0.33
	(7.03)***	(9.34)***
$\theta_{NP\ Corp}$	0.21	0.39
	(8.05)***	(11.24)***
$\theta_{NP\ Other}$	0.19	0.25
	(9.63)***	(9.25)***
Pr $[\theta_{NP\ Church} = \theta_{NP\ Corp}]$	0.07*	< 0.001***
Pr $[\theta_{NP\ Church} = \theta_{NP\ Other}]$	0.53	0.01***

Absolute value of t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Further research is needed to accurately explain why markups vary. While the results are consistent with my model, other explanations, such as systematic differences in market power, differences in fund raising ability, and cross subsidization of products are also valid explanations of the findings.

Not-for-profit hospitals may face a trade off between low markup ratios, uncompensated care and other community benefits. A complete analysis of not-for-profit firms should include pricing behavior, market demand, government/community support and competition when analyzing community benefit. This research primarily addresses pricing behavior.

CHAPTER III

PATTERNS OF ENTRY AND EXIT IN THE CALIFORNIA HOSPITAL MARKET: GOVERNANCE STRUCTURE AND INDUSTRY EVOLUTION IN A SERVICE INDUSTRY

The ownership structure of service industries differs greatly from manufacturing. Service industries have a much greater predominance of not-for-profit and government owned organizations. In addition the highly geographic nature of services encourages systems of firms linked through common ownership or common operating methods. These characteristics play a substantial, but poorly understood, role in the behavior of firms and the operations of markets. This paper uses the hospital industry to demonstrate that that governance structure and system membership are important factors in the entry and exit decisions of firms. It provides a framework and direction for studying the role of governance structure and system membership by revealing how firms with different ownership structures enter and exit. I find that entry and exit patterns, including entry and exit rates vary systematically with governance structure and system membership.

Introduction

In their seminal study on firm entry and exit, Dunne, Roberts, and Samuelson (1988) characterized the entry and exit patterns of US manufacturing firms. The study brought to light numerous patterns in the entry and exit of firms. They find that diversifying firms enter markets with relatively larger sizes than new firms. They also find that firms grow in relative size as they age. This study continues to inform research today. Their study focused on manufacturing, which has experienced steady and long term decline in the United States.

In this paper, I focus on patterns of entry and exit in the hospital market, a significant service sector industry. The service sector has experienced growth in recent years. Service industries function through fundamentally different mechanisms than manufacturing (Audretsch, Klomp, Santarelli, and Thurik 2004). Audretsh *et al.* find that Gibrat's law holds for small scale services, while it fails in a systematic manner in manufacturing industries. A number of empirical studies of service industries (Audretsch *et al.* 2004, Harhoff; Stahl, and Woywode 1998, Santarelli 1998) point to Dunne, Roberts, and Samuelson (1988). To my knowledge, there are no studies that document the entry and exit patterns in service industries. Because of this it is unknown how applicable the findings of Dunne *et al.* are to empirical service industry research.

There are two striking differences between service industries and manufacturing industries. The first difference is the presence of multiple forms of firm governance. Not-for-profit and government owned firms are virtually unknown in the manufacturing industries. The second major difference is the geographic nature of service markets. Service firms have relatively small market areas and typically expand by acquiring geographic space while manufacturing firms expand by increasing the product space or capacity. This aspect of the service industries is readily seen by the predominance of franchises within the service sector.

I extend Dunne, Roberts, and Samuelson's study to the service sector by analyzing the patterns of entry and exit of Californian inpatient hospitals. I introduce firm governance structure and system membership as important differentiating characteristics. I find that the hospital industry shares some characteristics with manufacturing industries, however differs in a number of important aspects. Like most manufacturing industries, entering hospitals are significantly smaller than incumbent hospitals and exiting hospitals are significantly smaller than surviving hospitals. The major differences between entry and exit patterns of hospitals compared to manufacturing industries relate to governance structure and system membership. I find that the patterns of entry and exit for hospitals vary systematically with both governance structure and geographic diversification (system membership). The nature of system membership in the service industry is significantly different than the manufacturing industry. I find that system membership gives both diversifying and new firms a significant advantage over single hospital firms. This advantage is manifested through larger relative entry size and lower exit rates. While my result is consistent with manufacturing industries, the advantage that system hospitals experience greatly outstrips the advantage that system membership affords manufacturing industries.

Governance structure is an attribute that is largely unexplored within manufacturing industries. Hospital for-profit firms have much greater entry and exit rate than not-for-profit firms. If entry is purely a response to market opportunity for-profit firms and not-for-profit firms would enter at proportionately similar rates.

I also identify system membership as an important factor in firm outcomes. System membership is associated with greater revenue, higher profit and lower exit rates. Over the last 30 years there has been a steady shift in the distribution of hospitals from independently run to system hospitals. My findings on system membership identify system membership as an important topic of future research in the service sector.

The hospital market has significant variation in both system membership and governance structure. This makes the hospital market the ideal place to begin identifying how the services differ from manufacturing. The value of this research extends beyond the industrial organization insights regarding the services, governance and geographic expansion.

Indeed, the provision of health care is one of the most prominent problems facing modern economies. In 2009, United States health care expenses accounted for 17.6% of GDP, roughly $8,086 per person. Increases in health care costs have outpaced inflation for over a half a century. Hospital expenses constitute the largest portion of health care spending and are consistently identified as one of the driving forces behind the growth in health care costs. Many professionals believe that structural problems within the health care market, such as excess market share and quality competition, are responsible for the rapid increase in hospital expenses. However, despite a significant amount of research into hospital markets over the last three decades, relatively little is known about how hospitals enter and exit markets.

To remedy this shortcoming, I conduct a detailed analysis of the evolution of entry and exit in the California hospital market between 1976 and 2008. The data are the most long-lived and detailed data on hospitals used in the literature. It consists of detailed financial and operating data for the universe of inpatient hospitals in California between 1976 and 2008.

This study covers a period of significant turnover in the hospital market. I identify yearly entry and exit rates averaging 9.5% and 10.5% respectively. The number of inpatient hospitals in California has decreased 28%, from 627 in 1976 to 451 in 2008. In addition the number of firms operating hospitals has decreased 44% from 435 to 246. This is particularly striking considering that California's population increased over 50% during the same time period.

Coinciding with the decrease in hospital facilities and an increase in average hospital capacity and proportion of hospitals affiliated with multi-hospital systems. Hospital systems can be thought of as the hospital equivalent of multi-plant manufacturers. Hospital systems have cost advantages, greater bargaining power with insurers, increased name recognition, better access to capital, and protection from regional shocks. While large hospital systems create more difficult negotiating environment for insurers, their presence gives insurers extended preferred provider network. The data that I use track hospital system membership over time. Through this I differentiate entry and exit of system members from non-system members.

Governance structure is a very important characteristic of the Californian hospital market. Dunne et al. (1988) and the entry and exit literature associated with their work do not address the role of governance structure. This is understandable because within the manufacturing sector governance structure is relatively homogeneous. In the hospital market, one of the most prominent firm characteristics is governance structure. Profit status, government affiliation, and board behavior all play critical roles in forming a hospitals objectives and behaviors. I explore the impact of governance structure on firm entry, market evolution, and exit. In Chapter II, I demonstrate that not-for-profits have significantly different objectives than for-profit and government run hospitals. Given that governance structure is related to firm objectives, governance structure should also play an important role in firm entry and exit decisions.

Researchers are beginning to model hospital entry and exit. This research focuses on the effect entry and exit has on the competitiveness of hospital markets (e.g. Abraham, Gaynor, and Vogt 2007). Very little is known about why and how hospitals enter and exit markets. Empirical results regarding the effects of entry and exit are often contradictory. My results provide insight into the issues underlying these contradictions. I demonstrate that entry and exit behavior varies over both system membership and governance structure. Firms with different governance structures and different levels of geographic affiliation make significantly different market exit decisions. An important consideration for hospital regulation is pricing behavior and community access to care. Without accounting for heterogeneous exit environments it is difficult to accurately predict the market effects of exit.

This paper identifies how the patterns of entry and exit for service industries in general and the hospital industry specifically differ from manufacturing industries. It serves two important roles. First, it identifies important directions for future research in service industries. Second, it provides a point of reference for both new research and critical analysis of existing studies on service industries.

In section 2 of this chapter, I provide background information on entry, exit, and the hospital market. Section 3 describes the construction of the data and summarizes trend in the key variables. The distribution of entry and exit patterns across governance structure, and the correlations in these patterns are examined in section 4. Section 5 focuses on post entry performance of hospitals by examining entrant market shares, sizes, growth rates, and failure over time. Section 6 summarizes the main findings and provides context for these findings within the existing manufacture based entry and exit literature.

Background

Prior to Dunne, Roberts, and Samuelson (1988), a significant body of work existed on entry and exit. This work focused on the market effects of entry and exit and left a surprising gap of knowledge surrounding the actual entry and exit decisions. Dunne et al. characterize the entry and exit of firms across a broad range of manufacturing sectors. They observe entry, exit, and firm characteristics in five year intervals between 1963 and 1982. The data reveal a number of important patterns:

1. Entry rates and entrant market share vary across two digit manufacturing sectors and across markets within each sector;
2. The market share of entering firms is disproportionately smaller than incumbents;
3. Market entry and exit rates are highly correlated across industries. Further, market entry rates and entrant market share are correlated across time. This suggests that industry specific factors contribute to entry and exit behavior; and
4. New firms entering markets tend are smaller than old firms entering with new plants but larger than old firms entering by diversifying existing plants.

Many of my findings can be related to Dunne et al:

1. Average entry and exit rates in the hospital industry vary by governance structure and system membership. Depending on the entry definition, hospital entry and exit rates are smaller than every manufacturing sector that Dunne et al. report and for most industries smaller by an order of magnitude;
2. Entering firms are smaller than incumbents. However the average disparity between the size of old and new firms is less pronounced for

hospitals than it is for every manufacturing sector that Dunne et al. report. New hospital facilities however are significantly smaller than incumbent facilities;

3. Because my study focuses on a single industry, I cannot provide correlations across industry. However, there is significant correlation between entry and exit across hospital ownership type. This correlation is much stronger than that found across manufacturing industries; and
4. The distribution of entry between new and old hospital firms is similar to manufacturing. I find that the preexistence of both hospital facility and firm is a significant factor in entry and exit patterns, however the nature of the data lead me to define new plants differently than Dunne *et al.* In their study, the differentiating characteristic between new and old plants is ownership; I identify old plants as having previously functioned as a hospital.

The size distribution of firms tends to be skewed towards small firms, with many firms apparently operating below the minimum efficient scale for their industry. Dunne et al. (1988) and Audretsch and Mahmood (1993) demonstrate that firms tend to enter small and only firms that grow survive. Older firms are competitive based on economies of scale while younger firms are competitive based on innovation (Autdretsch and Mahmood 1993). Liu (1993) models the relationship between firm efficiency, entry, and exit. The findings suggest that firm efficiency is heterogeneous within industries and that competition tends to push less efficient firms out of the market.

This track of entry literature has led to the formulation of a stylized result that firm size and age are correlated with entrant survival (Geroski 1995.) Entry size is consistently found to be positively related to firm survival. This result is inconsistent with Gibrat's Law on the independence of growth and firm size. My tabulations of entry and exit statistics support this empirical observation.

The literature on firm entry evolves out of Joe Bain's (1956) work in "Barriers to New Competition." A survey of the literature reveals entry as a key mechanism for maintaining equilibrium prices and profitability (Audretsch and Mata 1995). A near universal result in this literature is that entry leads to greater levels of competition, which in turn drives down prices. However, a number of researchers have suggested that this result does not necessarily extend to the hospital industry.

Rapidly growing health care cost and a wave of hospital closures in the 1970s and 1980s has lead researchers to closely examine the structure and performance of hospitals. A major hypothesis that evolved out of this research was that hospital competition may lead to inefficiency through excess investment (Robinson and Luft 1985, Kopit and McCann 1988, McLaughlin 1988, McManis 1990).[3] This phenomenon arises from a regime of independent physician and the externalization of health care costs as a result of insurance (Dranove and Statterthwaite 1999).

Under the traditional medical system, physicians operate as independent financial entities. To take advantage of economies of scale in operating facilities they share hospital services. When multiple hospitals exist within a market physicians tend to associate with a single hospital. Patients generally bear only a portion of the financial costs involved in the physician's hospital choice. This leads physicians to choose hospitals based on quality rather than price. Thus, hospital competition becomes a case

[3] This idea, often referred to as the medical arms race (MAR), is debated in an extended range of literature. The extent of the arms race may be sensetive to market definition (Dranove Shanley Simon 1992). Dranove, Shanley, and White (1993) find that the rise in managed care and Medicare's switch to DRG repayment systems shifted hospital's competitive focus from quality to price. Conner, Feldman, and Dowd (1997) conferm Dranove and associates' hypothesis that managed care increases price competition. Kessler and McClellan (2000) find competition has an ambiguous effect on welfare in the 1980s but significantly improved social welfare in the 1990s. However, Devers, Brewster, and Casalino (2003) document a new MAR beginning in 2001. They suggest that consolidation in the hospital market is the driving force behind this shift. Dranove and Statterthwaite (2000) provide a brief summary of the MAR literature up to 1998.

of quality competition addressed by Spence (1975). More specifically, it is a form of quality competition whereby firms drive down profit through over-investment of capital.

Entry of hospitals then imposes two contrary forces on hospital prices, with price competition acting in opposite of quality competition. This result has motivated a closer examination of hospital entry, exit, and competition. Under these circumstances there is no clear relationship between entry and welfare. The hospital literature on entry has centered on resolving the welfare implications of hospital entry and exit. However, a secondary, and unexamined implication, is that the entry and exit behavior of hospitals likely differs from standard patterns. This behavior includes entry decisions regarding capacity, horizontal diversification, and firm governance.

The current literature on entry and exit in the hospital market focuses on using entry and exit to identify competitiveness and on identifying the welfare effects of entry and exit. Abraham, Gaynor and Vogt (2007) utilize Breshnahan and Reiss' (1991) threshold population model to identify how quickly competition affects market power. They find that the benefits of competition converge rapidly, with majority coming from the second and third entry. A drawback to the threshold population approach is that it cannot identify the competitiveness of the converged market.

Some argue that hospital entry actually leads to a type of quality competition referred to as the "medical arms race." Dranove, Shanely and White (1993) review the literature on the medical arms race and provide a comprehensive exposition on quality competition. They confirm its importance, however they also note that the rise of managed care has led to a payer driven competition that helps to limit this trend. They suggest that the switch from patient to payer driven competition has little relationship between hospital entry and exit.

A number of researchers have identified that hospital exit patterns change over time. A study on hospital exit conducted by Ciliberto and Lindrooth (2007) is particularly relevant to the survival literature reviewed above. They find that firm efficiency is not a factor in hospital survival during the early 1990s; however it is, during the late 1990's. The analysis in this chapter is less sensitive to structural change in markets because it does not impose a specific model onto the data.

While there is a small body of research existing on hospital entry and exit, the hospital industry has not benefited from the type of empirical tabulations that form the foundations of Geroski's stylized results.

Data

For this analysis, I construct a 33 year panel from Californian hospitals using California's Office of Statewide Health Planning and Development (OSHPD) Annual Hospital Financial Data. The panel consists of all inpatient hospitals operating in California between 1976 and 2008. Due to its completeness, these data appear in the recent hospital literature. Yet, no research has taken advantage of the entire length of these data. Indeed, most of the studies span periods fewer than 10 years.

The data used in this study are not representative of the United States. There is significant variation in hospital markets between states with regard to both governance composition and as such caution should be taken when applying these findings to other regions. However, because these data are used in many recent studies, the results will be comparable to the majority of existing hospital market literature.

In this analysis, I include hospitals of all care types. Table 8 provides a cross tabulation of hospitals by governance structure and type of care. There is some variation in type of care between governance structures. In particular, for-profit hospitals are over-represented in short term psychiatric hospitals and government hospitals have a larger portion of long term care hospitals. This variation in type of care drives some of the observed differences between governance structures.

Table 8: Type of Hospital by Governance

	Not-For-Profit		For-Profit		Government	
Long-Term Children	1	0%	16	0%	3	0%
Long-Term General	130	1%	205	3%	138	4%
Long-Term Psychiatric	17	0%	39	1%	73	2%
Long-Term Specialty	97	1%	32	1%	91	3%
Short-Term Children	288	3%	3	0%	1	0%
Short-Term General	7,435	86%	4,173	70%	2,772	80%
Short-Term Psychiatric	376	4%	1,161	19%	370	11%
Short-Term Specialty	337	4%	359	6%	15	0%
Total	8,681		5,988		3,463	

I study entry and exit patterns over a 33 year period. This period covers numerous paradigm shifts in the hospital industry. These changes include new Medicare and Medicaid reimbursement policies, new modes of insurance, vastly different medical technology and an evolving epidemiology. The impacts of these changes are difficult to disentangle because many of these changes occur simultaneously and extent over multiple periods. My methodology allows analysis of entry and exit without imposing an artificial structure around this dynamic environment.

Data Construction

The data consist of all Annual Hospital Disclosure Reports submitted to the State of California between 1977 and 2009. The first year of data, 1976, is unavailable due to tape storage deterioration. These data are collected annually by the State of California's Office of Statewide Health Planning and Development (OSHPD). In addition I use Bureau of Labor Statistics data on the consumer price index to deflate monetary variables.

The State of California mandates that all hospitals in California which provide inpatient care[4] submit a yearly detailed report on their operations. Every year OSHPD compiles individual annual reports into a single data set available as a flat file. Included in the report is information on ownership, governance structure, services, capacity, utilization, and cash flows. The annual report has been modified several times since the policy was initiated in 1975; however many of the variables of interest are included for the entire rage of report years. In addition to the variables that have not changed over the report years, temporally consistent variables can be constructed from the data fields that experience some yearly variation.

[4] Inpatient care is considered care provided to patients that require at least one overnight stay in hospitals.

Reports are submitted yearly for each owner of each facility. Thus, the unit of observation is an owner-facility-year. Each report covers the accounting year containing the first day of the year for which the report is submitted. Nearly 70% of observations start in either January or July.[5] Due to the staggering of start months, some of the yearly data sets provided by OSHPD include data from years preceding and following the report year. Generating market shares and many other variables used in this analysis without compensating for staggered starting months would blend yearly trends and introduce significant error into the results.

To correct for staggered starting months, new variables were created by combining reports when reporting periods spanned more than one year. Only variables that are directly influenced by the specific report period, such as revenue and discharges, are modified. Variables that are expected to change only once, variables that are not time dependent, categorical variables and non-numeric variables are not modified. The reported amount for each modified variable was split three new variables by weighting the reported values with the percentage of the report that fell into that preceding, present, or following calendar year. All weighted observations with the same calendar year were then summed into a single observation. Thus the variable V for owner o, facility f and year t, V_{oft}, became $V_{1oft} = a/(a+b+c)*V_{oft}$, $V_{2oft} = b/(a+b+c)*V_{oft}$, and $V_{3oft} = b/(a+b+c)*V_{oft}$, where a is the number of reported days falling in the year preceding the report year, b is the number of reported days falling in the reported calendar year, and c is the number of reported days falling in the following calendar year.

[5] When excluding hospitals not reporting a full year January and July each gain one percent more mass; the rest of the distribution does not change significantly.

I then replace $V_{oft} = V_{1of(t+1)} + V_{oft} + V_{of(t-1)}$. These new variables, along with variables that were not modified, comprise the annualized data.

The number of days spanned by the report is identified through the reporting period start date and the reporting period stop date. Small masses are focused at 30 day intervals with a small peak at a half year and a large peak at a full year. Many of the reports with periods less than one year are due to firm entry and exit. Excluding entry and exit shifts a significant mass of days to both full and half years. Annualizing the data also shifts more mass to 365 days. In the raw data 91% of observations report a full year while excluding entrants and exiters from the annualized data results in 98% of observations reporting full years. Because some partial year reports remain in the data accumulating variables such as yearly revenue are converted into average daily revenue.

The data are constructed as a 33 year balanced panel. I conduct my analysis at three different levels: facility, firm, and facility-firm. With facility and year as the unit of observation approximately 30 observations per year are not uniquely identified. This is due to primarily to ownership changes that occur during the reporting period. The remaining non-unique observations are duplicates due to partial year reports. Annualizing the data resolves duplication issues in two ways. At the facility level of analysis, ownership is not relevant. Variables which accumulate over time, such as yearly sales, are summed within each year and across ownership. Variables which do not accumulate over time, such as beds licensed are averaged across duplicate observations. The annualizing the data at the facility level does pose one limitation. Facilities that switch governance between years rather than at the year's end actually operate under two different governance structures within the same observation. Excluding these observations does not significantly affect my findings.

Facility is defined as a single hospital operating in a particular location. The data contain 799 unique facilities. These facilities are tracked over time through a state assigned facility ID number. The method of assigning facility ID numbers was modified in the first few years of report collection. This resulted in a mismatch of facilities over the period 1976-1982. These facilities were matched by hand by comparing facility name, city, and address.

Hospital ownership is an item reported by each hospital. Ownership is reported by name rather than a single tracking number. Entry error, abbreviations, punctuation and several other issues make matching ownership across report years and facilities problematic. Hospital ownership is hand matched based on similarities in reported ownership. Governance structure, year, and facility ID were used to aid matching decisions when reported ownership alone created ambiguous matches. Firms reporting ambiguous owner names, such as "A nonprofit corporation" or not reporting an owner were matched to the temporally closest reported owner for the facility unless the closest reported owner was of a different governance structure than the observation with the missing owner. Reported owners with identical spelling, or with spelling that varies only by spaces, abbreviations, punctuation and missing or extra characters were matched together. Owners with slight word changes or subsets were compared with the owner names and governance type of the facility in previous and following years. If previous or following owners had similar names and the same profit status the owners were matched.

After matching the data as described above, the number of unique owners observed in the data is reduced from 3,361 to 977. The number of unique owner-facilities is 2,054.

The described method of matching may result in two types of errors. It may fail to match owners across facilities and time or it may incorrectly match owners across facilities and time. I conducted several checks to confirm matching accuracy. First, I examined owners that had gaps in the years that they owned a particular facility. Second, I searched for owners who had gaps in owning any facility. Finally, I searched for owners that switched governance type. Each case of possible error was addressed on an individual basis.

All Californian inpatient hospitals are required to submit an annual report if they operate for any length of time in a given report year. For this reason, if a report is not filed for a particular facility in a particular year, it is assumed to have not participated in the market that particular year. Similarly, if an owner did not file a report for a particular facility in a particular year the owner is assumed not to have operated that facility that year.

This study considers entry and exit at three different levels: facilities, firms, and firm in a particular hospital market. I construct three binary entry variables and three binary exit variables. Facility entry in year t takes a value of 1 if the facility operates in year t and does not operate in year $t-1$. Facility exit in year t takes a value of 1 if the facility operates in year t and does not operate in year $t+1$. Owner-Facility entry in year t takes a value of 1 if the owner o operates hospital h in year t and owner o does not operate h in year $t-1$. Owner-Facility exit in year t takes a value of 1 if owner o

operates hospital h in year t and owner o does not operate hospital h in year $t+1$. Owner entry in year t takes a value of 1 if owner o operates any facility in year t and does not operate any facilities in year $t-1$. Owner exit in year t takes a value of 1 if the owner operates any facilities in year t and does not operate in year $t+1$.

Table 9 summarizes the entry and exit of firms over the observed period. Observations designated as problem firms have multiple entries, multiple exits, or exits preceding entries. These patterns are due to missing reports, facility or owner matching errors, or temporary hospital closures. The majority of the analysis excludes firms with erratic entry behavior.

Table 9: Entry and Exit in California

	Number of market entities
Always in market	83
Only exit	435
Only enter	277
Enter then exit	1,025
Erratic entry	232

Summary of Data

Over the extended period, there is significant structural change. Before analyzing entry and exit behavior, I summarize the basic trends in the data. This summary reveals a number of important characteristics regarding the California hospital market. There has been a steady decline in the number of hospitals in California since 1977 (Figure 2.). This coincides with the first national push to fight hospital cost inflation lead by President

Carter. The decrease is driven entirely by independent hospitals. The number of independent hospitals in California dropped in half from 381 in 1977 to 193 in 2008.

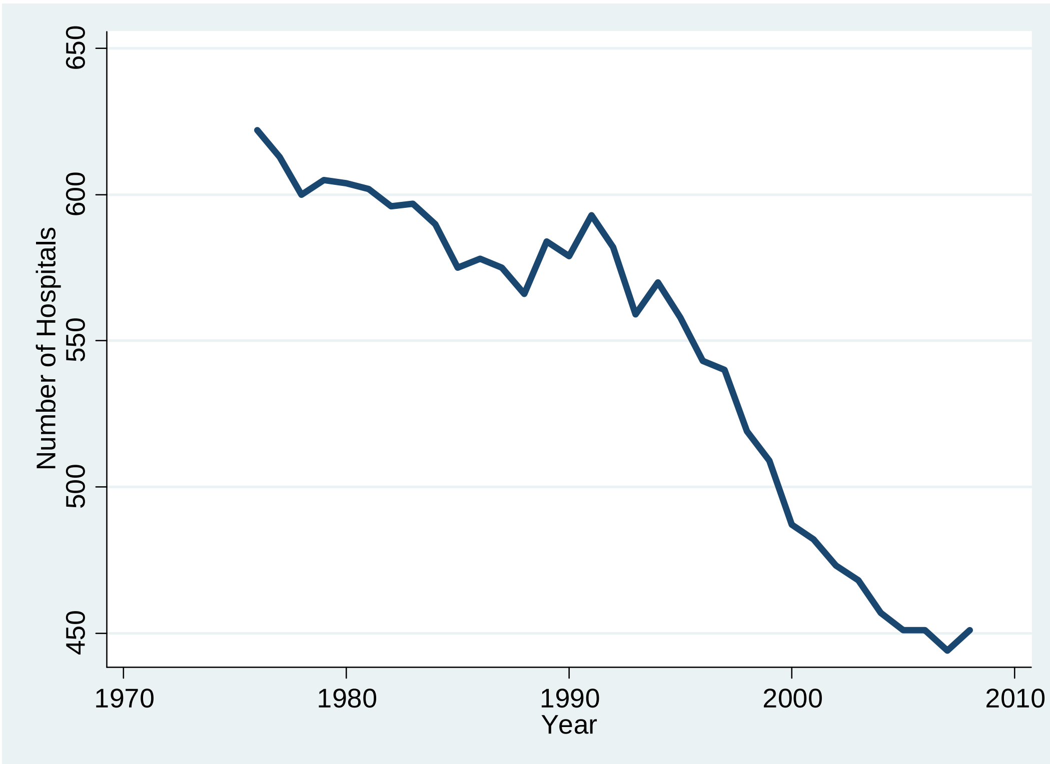

Figure 2. Hospitals in Market

The decrease in hospitals is not constant across governance structure or system membership (Figure 3). In fact, in the early 1990s, the number of not-for-profit hospitals in the market increased. The number of not-for-profit hospitals does not begin declining until the late 1990s. This is consistent with the idea that not-for-profit firms are less sensitive to profit, hence slower to exit markets than for-profit firms.

Coinciding with this decline in the number of hospitals has been a growth in California's population. The population of California has steadily increased from 22 million in 1976 to 38 million in 2008. The decrease in the number of hospitals coupled with the increase in population suggests that hospitals experience greater volume than in the past. Usage statistics, which I present later in this section, provide strong evidence for this finding. However, per capita hospital visits does decrease. One possible explanation for this decrease is that many previously invasive procedures can now be conducted without overnight observation. This has given rise to numerous ambulatory surgery centers.

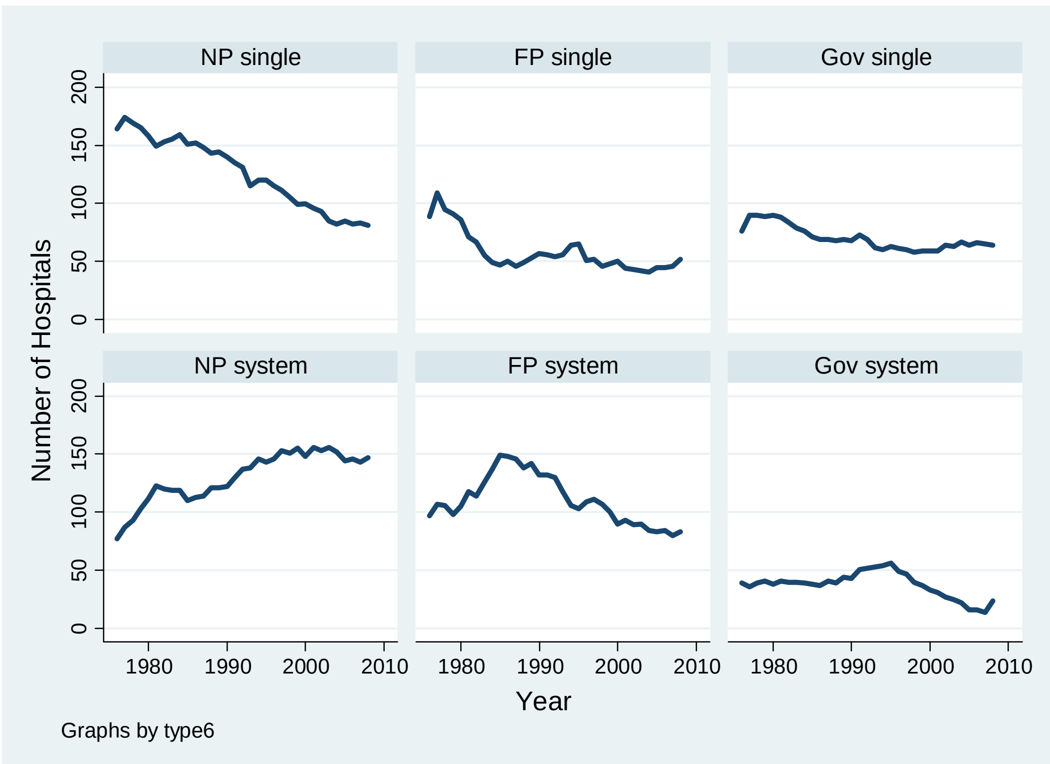

Figure 3. Hospitals in Market by Governance and System Membership

The number of hospital firms in California has decreased more rapidly than the number of hospitals. The number of hospital facilities has decreased 28% over the study period and hospital ownership has decreased 40%. This represents a substantial consolidation of hospitals. Figure 4 depicts the decrease in the number of firms over time. Firms operating single facilities experience the greatest decline. Multi-hospital firms increase until the early 1990s, than begin to gradually decline. Single facility firms appear significantly disadvantaged in the hospital environment of the 1970s, 1980s and 1990s.

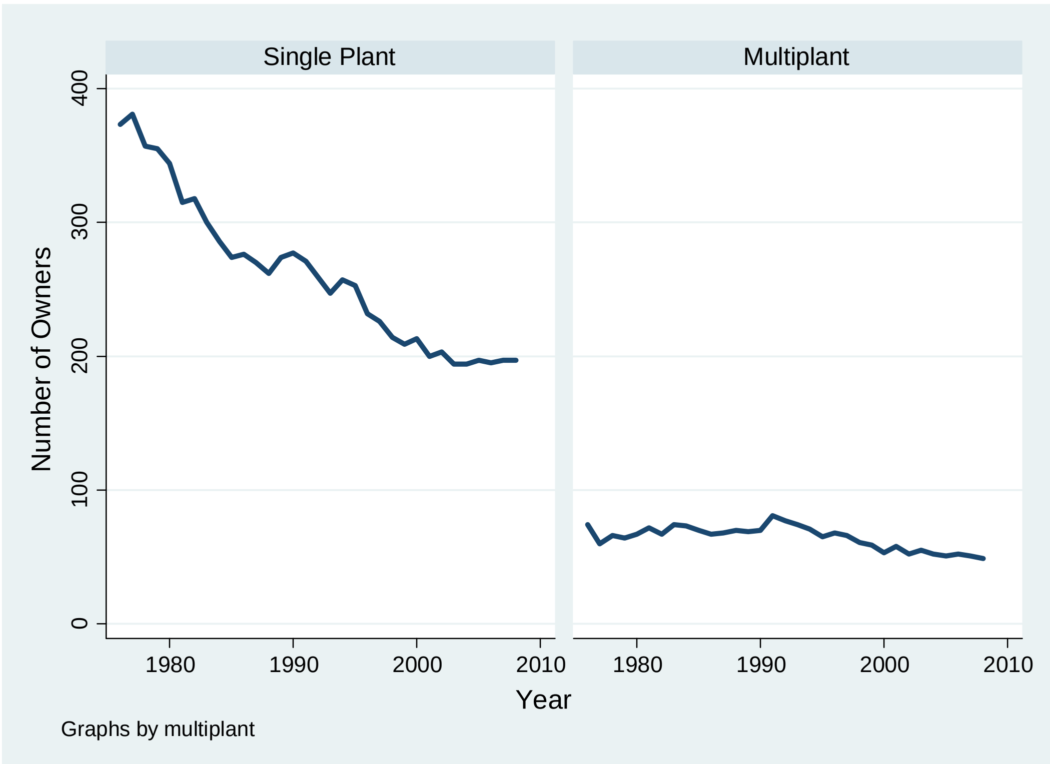

Figure 4. Owners in Market by System Membership

Examining the trend in total hospitals by both governance and system membership underscores the importance of both of these factors in the hospital market. System hospitals of all three governance structures experience an increase in numbers at some point during the time period. However, not-for-profit hospital systems are the only group of hospitals that experience an increased number of facilities over the entire study period. Single member hospitals of all governance structures experience decline over the study period.

Further, declines in single member hospitals are matched by increases for system hospitals of the same governance during the same time period. Single not-for-profit hospitals decline over the entire study period while system not-for-profit hospitals increase over the entire period. Single for-profit hospitals experience a sharp decline over the first ten years of the study period while system for-profit hospitals experience a sharp increase over the first ten years of the study period. With government hospitals there appears to be a small lag before system hospitals increase.

This pattern could have several explanations. System membership could be the first response to firms experiencing financial difficulty. Increased HMO membership, insurer hospital negotiation, and governmental pressure on hospital cost containment in the late 1970s, and 1980s created significant pressure on hospitals. System membership may increase bargaining power of hospitals and reduce operating costs through economies of scale and scope. However, the benefits of system membership may not have been enough to compensate for the more difficult operating environment. For-profit firms are believed to be more sensitive to losses than not-for-profit firms. Following a switch to system membership many for-profit firms exit the market.

An alternate hypothesis is that the more profitable firms switch to system membership. This hypothesis makes more sense when considering for-profit hospitals than not-for-profit or government run hospitals. Profitable hospitals may be attractive acquisition targets for growing firms. For-profit systems may have found the early 1980s to be a period of optimism, with firms expanding through acquisition, only to be faced with increased price competition in the late 1980s and 1990s, leading to high exit rates of for-profit hospital systems. A third possibility is that single member hospitals facilities actually close in low demand markets and system facilities open in high demand markets. A review of trends in the financial and operating characteristics of California hospital markets may help inform this issue.

Figure 5 depicts real total yearly operating revenue summed within governance types. Real operating revenue has consistently increased for all governance types; however, not-for-profit hospitals experience a significantly greater increase in revenue. In the late 1990s, hospital cost inflation was successfully halted. This is the only sustained period of stable inflation adjusted hospital revenue. The stability of hospital costs during this time period is largely attributed to increased price competition driven by the rise of managed health care organizations.

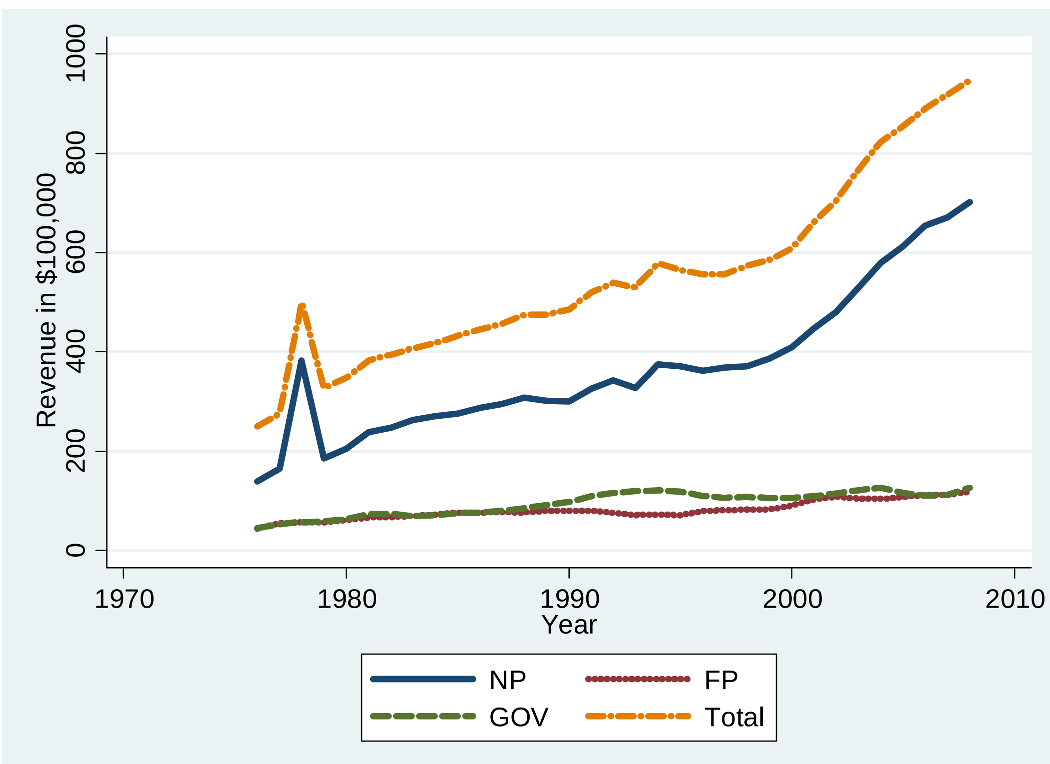

Figure 5. Real Daily Operating Revenue, Total by Governance

The outstanding growth rate in operating revenue for not-for-profits is due in part to an increase in the relative number of not-for-profit hospitals. When considering mean operating revenue, government hospitals match not-for-profit hospitals growth until the late 1990s. Between 2000 and 2008, non-profit revenue growth far outstrips for-profit and government hospitals. This period is associated with a resumption of hospital cost inflation claimed to be due to an increase in hospital concentration. However, the number of owners in the market stays constant during this period, and while the number of hospitals in the market does decrease, it decreases at a lower rate than in the previous decade.

The increase in real revenue is not due to an increase in hospital services. The total number of licensed beds (Figure 6) and hospital patient days[6] (Figure 7) in California decreases by approximately 20% over the study period. Hospital discharges (Figure 8) increases slightly over the study period, with not-for-profit discharges increasing, for-profit discharges constant and government discharges decreasing. During this period the days per discharge decrease slightly across governance structure (see Figure 9)

There are two potential explanations for these observations. Surgical procedures have become much less invasive over time. This limits recovery time and in some cases allows same day discharge. Beginning in the early 1990s ambulatory surgery centers, standalone facilities without overnight capacity, began increasing in number. This likely accounts for the fact that discharges remain constant in the face of rising population.

[6] A patient day is defined as an individual patient spending any amount of time in a hospital in a particular 24 hour period.

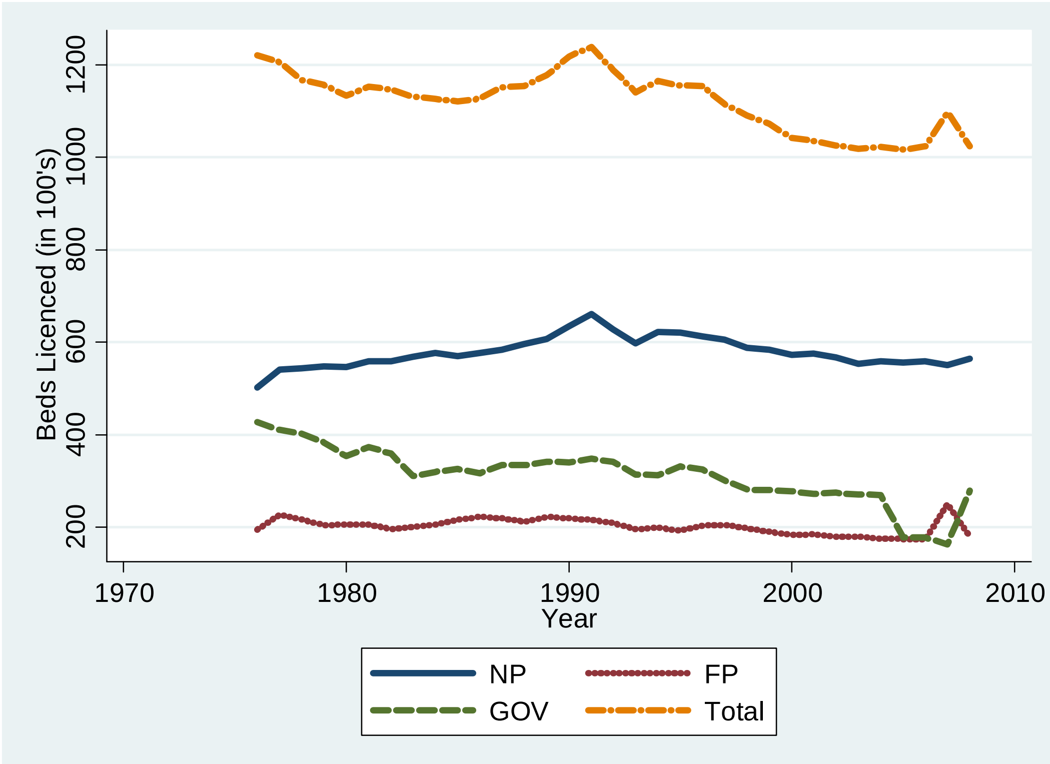

Figure 6. Capacity, Total by Governance

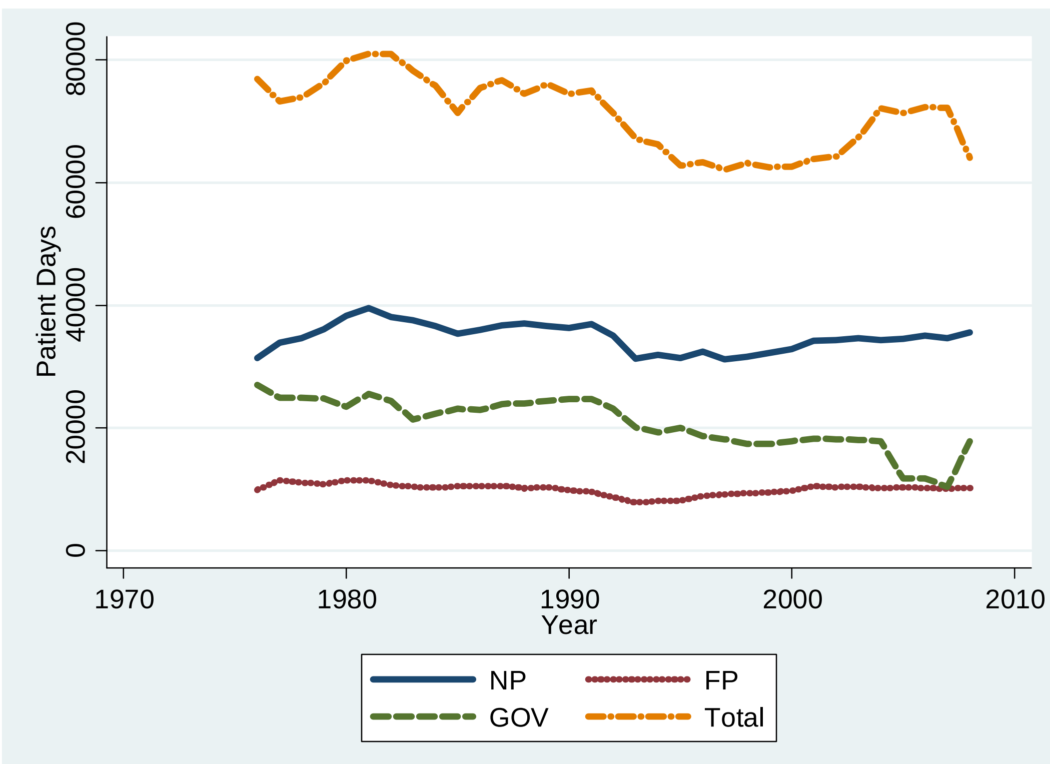

Figure 7. Daily Patient Days, Total by Governance

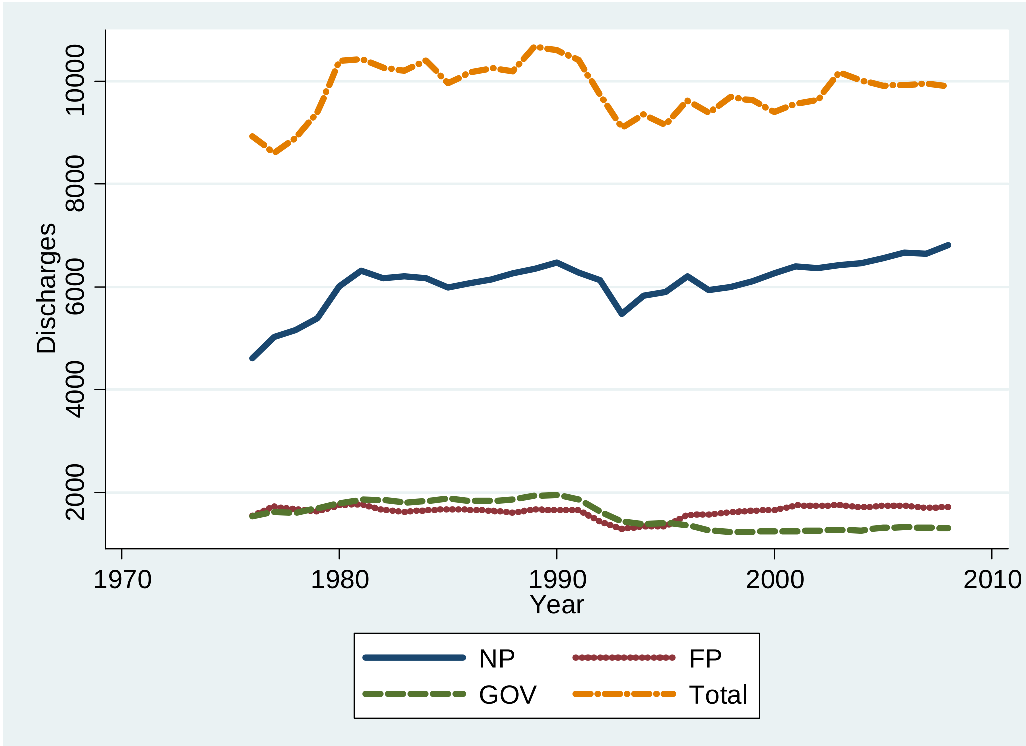

Figure 8. Daily Discharges, Total by Governance

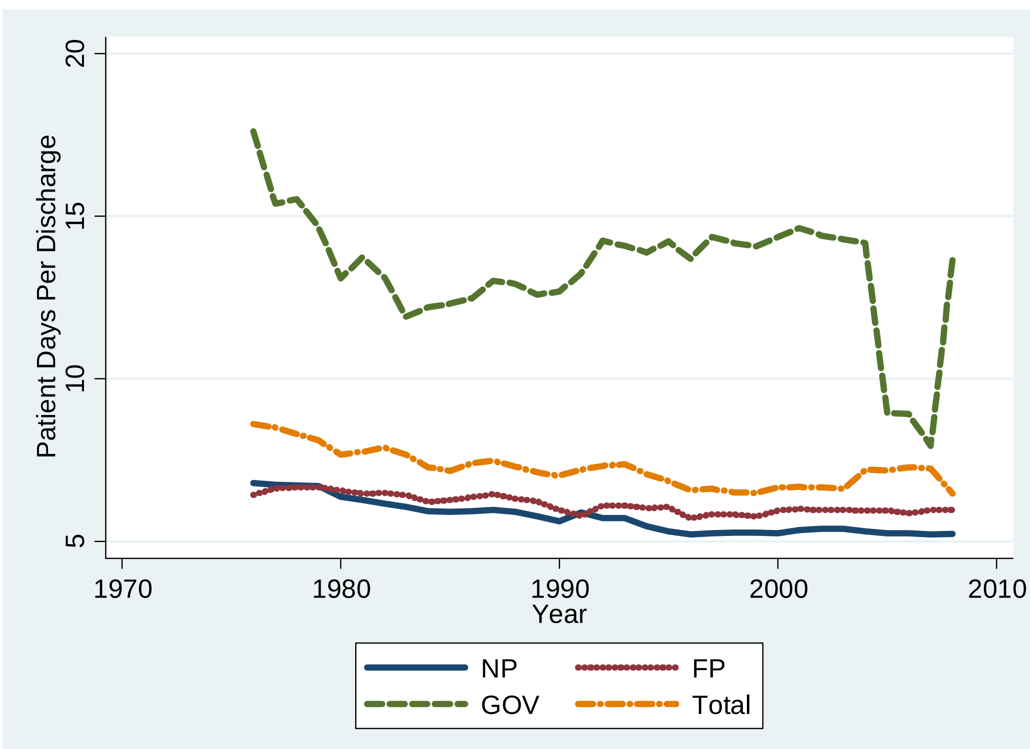

Figure 9. Patient Days per Discharge, Mean by Governance

The average capacity of individual hospitals (Figure 10) increases slightly for both not-for-profit and for-profit hospitals. Government hospitals experience a significant decline in capacity in the late 1970s. For-profit hospitals average half the size of not-for-profits and one third the size of government hospitals. This suggests that the role of capacity in the operation, entry and post-entry performance of hospitals depends on hospital governance structure. I explore this idea further in sections 4, 5 and 6. It is interesting to note that government hospitals on average have higher capacity and patient days but fewer discharges. This is likely because government hospitals tend to play a greater role in long-term care.

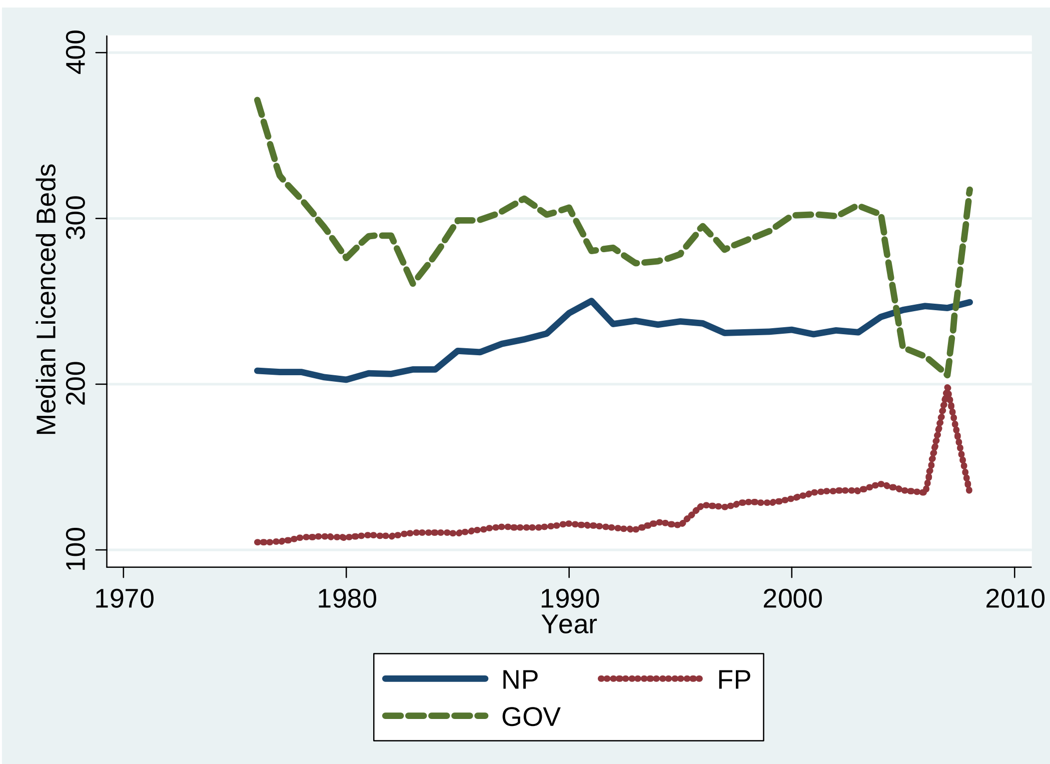

Figure 10. Hospital Capacity, Median by Governance

The literature on concentration in the hospital market places considerable emphasis on the role of governance structure without identifying or adequately accounting for the fact that firms with different governance structures tend to provide a different mix of services to a different mix of patients. Most researchers simply exclude hospitals that are not self-identified as short term general hospitals. By doing this, much of the richness in the interactions and operations of different governance structures is lost. A brief examination of revenue per patient day can demonstrate this.

Median real revenue per patient day (Figure 11) increases by a factor of 10 from $481 in 1976 to $2970 in 2008. Real revenue per patient discharge also increases by a factor of 10 from $2,970 in 1976 to $28,929 in 2008. These are indeed substantial increases; both revenue per day and revenue per discharge grow at similar rates. Figure 11 contains graphs of real revenue per patient day by system membership and governance structure. Revenue per discharge in 2008 is only $22,748 for not-for-profit system hospitals and $313,583 for government system hospitals. The extraordinary increase in government revenue per discharge is due a few long term care hospitals experiencing longer days per discharge. Withstanding government system hospitals, I now have results that are consistent with the fact that hospital stays are shortening. Clearly government system hospitals function in a different environment and serve a distinctly different market segment than other types of hospitals.

Coupling this observation with the fact that government system hospitals decreased by 75% from 1995 to 2007 suggests that long term care in California has experienced dramatic change in the last decade. Neither the decline in government hospitals nor the effects of this decline on the market has been addressed by the current literature. Government owned facilities are often considered “safety net” hospitals for low income and uninsured populations.

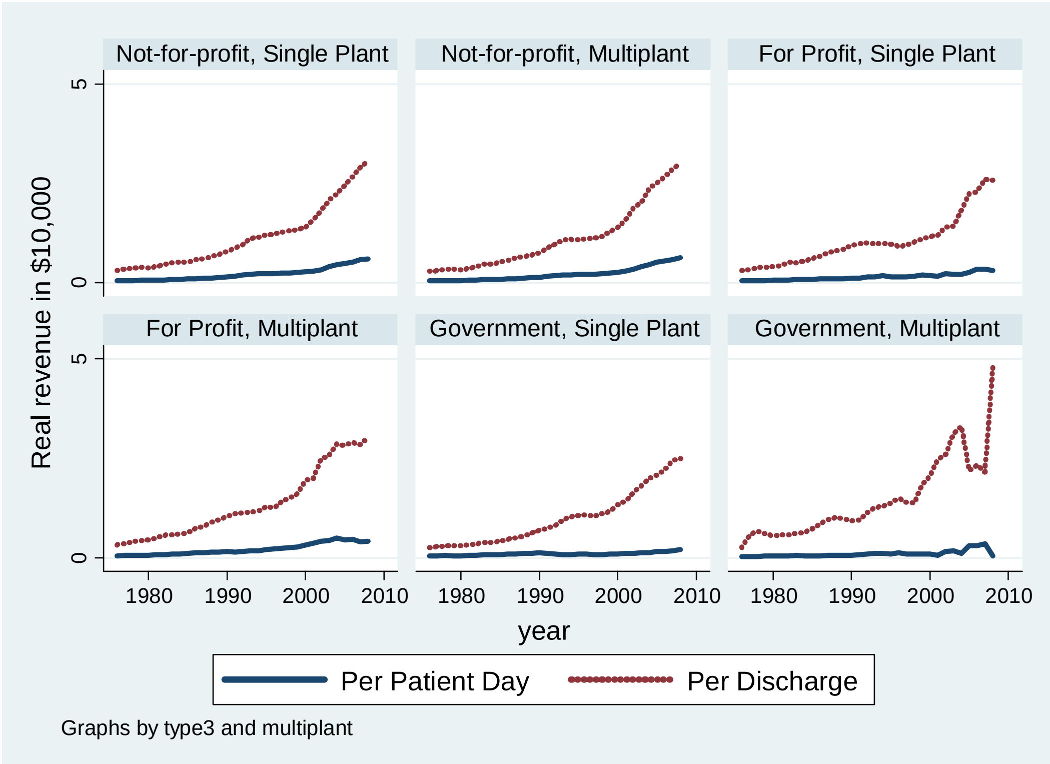

Figure 11. Real Hospital Revenue, Median by System Membership

The hospital market concentration literature is primarily concerned with the effect on local markets from hospital mergers. This places a focus on concentration within relatively small geographic markets. Multi-hospital systems tend to extend beyond the boundaries of the standard market definitions. System owners represent 20% of hospital owners in California; however they currently generate 60% of revenue (Figure 12).

Before 1990, system hospitals tended to operate at large losses. After 1990, system hospitals operated at large profits. Throughout the entire period single member hospitals had relatively little profit or loss. While systems tended to lose money before 1990 and earn after, the number of system hospitals increased before 1990 and decreased after (Figure 13). This suggests that agglomeration and multi-plant economies of hospitals may be the underlying mechanism driving the switch from loss to profit in system hospitals. Scherer (1975) documents the existence of multi-plant economies of scale. These data demonstrate that the hospital market has evolved to and environment that favors these economies.

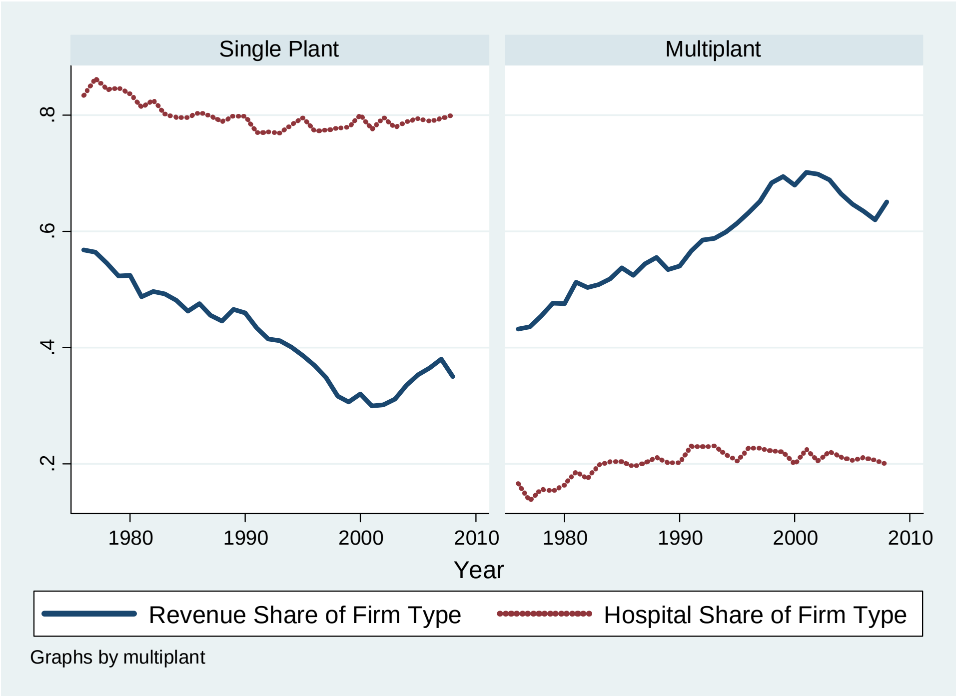

Figure 12. Share of Revenue Relative to System Membership

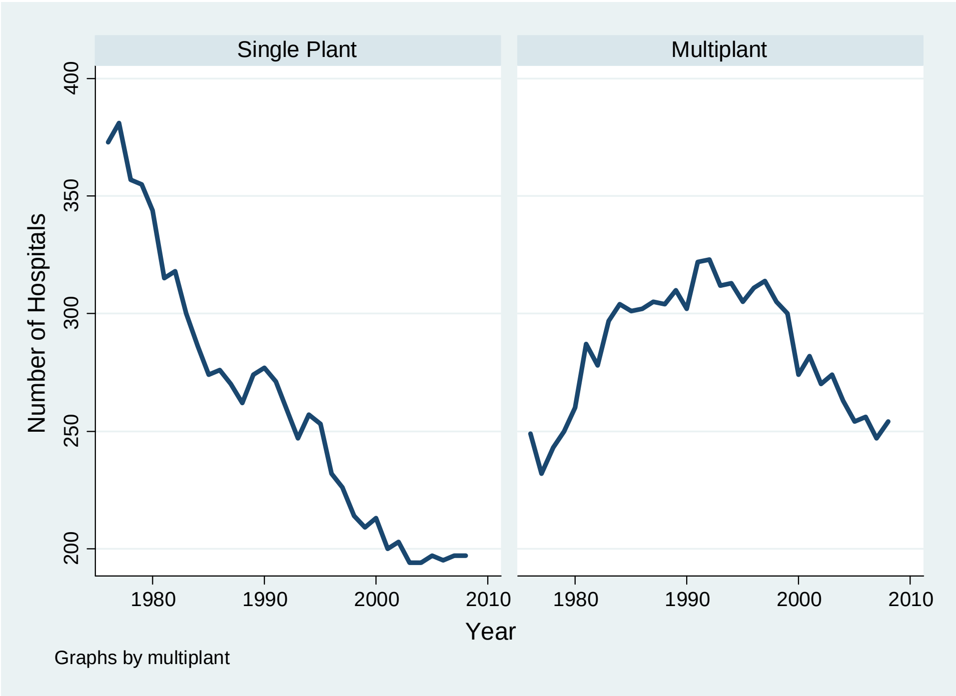

Figure 13. Hospitals in Market by System Membership

In a study of the determinants of mergers, Tremblay and Tremblay (1988) point to three reasons for mergers. First, mergers could lead to increased market power and greater profit margins. This motivation is particularly pertinent for mergers between geographically close hospitals. However, even mergers occurring across markets could lead to a greater exercise of market power improved bargaining positions with insurers. The second motivation for merging is multiplant economies of scale. Their third explanation is that merging is an efficient method of transferring assets from failing operations to successful operations. Within the hospital industry a fourth motivation should be considered. If firms include the welfare of consumers in their objective function firms may merge to maintain access to care in underserved regions.

The acquisition behavior of hospital systems could provide a clue to hospital objectives. One of the current conflicts in the hospital merger literature is whether mergers result in monopoly pricing. The standard approach to this issue is to identify post merger changes in pricing. However, if mergers occur as part of an attempt to save a failing hospital increased prices are to be expected.

Figure 14 depicts median real net operating income per day for different governance structures. The preceding discussion suggests that, while the hospital market is an established industry, it has and is currently undergoing significant change. An important factor in this change relates to the rise of the not-for-profit system hospitals. In the sections that follow, I examine the entry and post entry behavior of hospitals. I identify how the entry behavior of not-for-profit hospitals differs from that of both for-profit and government hospitals.

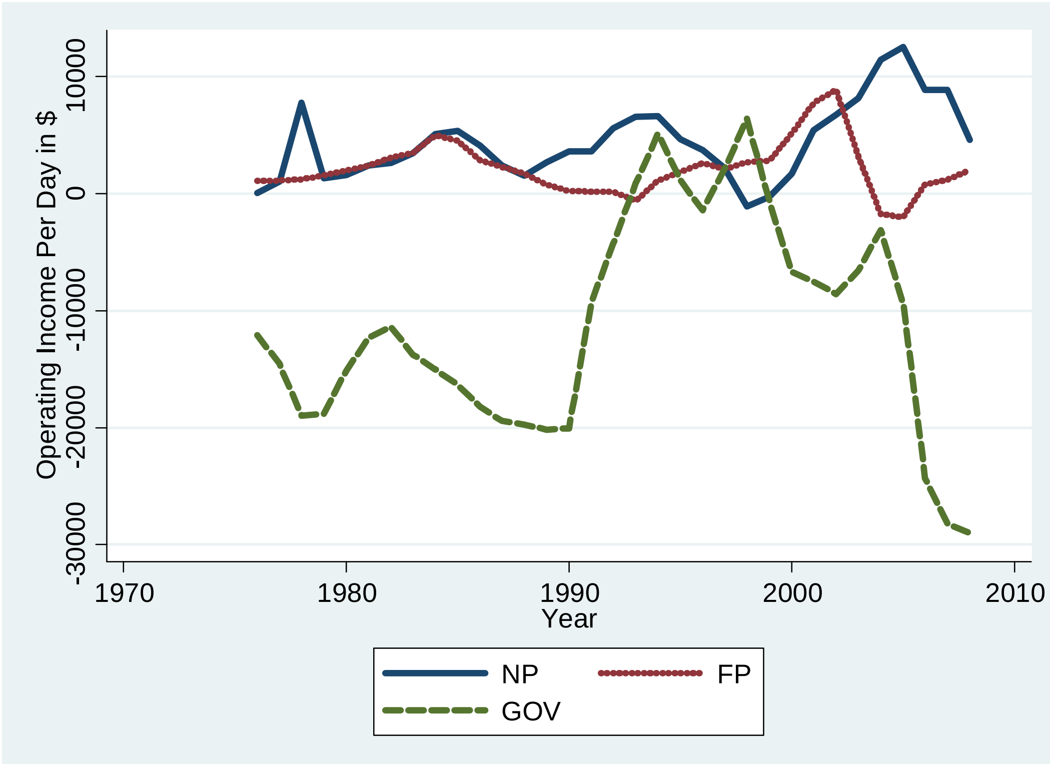

Figure 14. Daily Net Operating Income, Median by Governance

Description of Entry and Exit Measures

I use the data described to construct a number of measures relating entrants and exiters to the rest of the industry. These measures are described here to make the sections that follow more tractable.

$NE_{egs}(t) =$ number of entities e in (facilities, facility/owners, owners) with governance structure g in (not-for-profit, for-profit, government) and system membership status s in (member of hospital system, single hospital firm) that enter between the year $t-1$ and t.

$NT_{egs}(t) =$ number of entities e in (facilities, facility/owners, owners) with governance structure g in (not-for-profit, for-profit, government) and system membership status s in (member of hospital system, single hospital firm) that exist in the market in year t.

$NX_{egs}(t-1)$ = number of entities e in (facilities, facility/owners, owners) with governance structure g in (not-for-profit, for-profit, government) and system membership status s in (member of hospital system, single hospital firm) that exit between the year $t-1$ and t.

$QE_{egs}(t)$ = total output of entities e in (facilities, facility/owners, owners) with governance structure g in (not-for-profit, for-profit, government) and system membership status s in (member of hospital system, single hospital firm) that enter between the year $t-1$ and t.

$QT_{egs}(t)$ = total output of entities e in (facilities, facility/owners, owners) with governance structure g in (not-for-profit, for-profit, government) and system membership status s in (member of hospital system, single hospital firm) that exist in year t.

$QX_{egs}(t-1)$ = total output of entities e in (facilities, facility/owners, owners) with governance structure g in (not-for-profit, for-profit, government) and system membership status s in (member of hospital system, single hospital firm) that exit between the year $t-1$ and t.

Entry and exit rates are defined using the above variables:

$$ER_{egs}(t) = NE_{egs}(t)/TN_{egs}(t-1)$$

$$XR_{egs}(t) = NX_{egs}(t-1)/NT_{egs}(t-1)$$

These rates assume that entrant and exiter pools are segregated by both governance structure and system membership. This assumption has strong support for all cases except distinguishing between single not-for-profit and for-profit entrants. The support for segregating exiters is self-evident as firms can only exit as a particular governance structure or system member is they existed as such in the prior year. The vast majority of system entry for both facilities and facility/owners occurs by firms existing in prior years. Thus, preexistence restricts the entry pool to particular governance/system memberships. Single hospital entry pools are not observed. Because the pool of entrants is not observed entry rate is calculated using the number of firms in the market during the preceding year as the denominator. Government entry is not a form of entry that is available to general entrepreneurs. However, it is possible that not-for-profit and for-profit entrants come from a single pool. A more appropriate measure of entry rate for these two cases (non-system entry by not-for-profits and for-profits) could be $ER_{egs}(t) = NE_{egs}(t)/\sum_{g\in(np,fp)} TN_{egs}(t-1)$. These rates are defined in a manner consistent with entry rates of Dunne et al. in order to allow a comparison of my results.

The impact of entry and exit on market structure depend on the relative size of entering and exiting firms. To track this dependence, I define entrant market share and entrant relative size. Entrant and exit market share is computed as:

$$ESH_{egs}(t) = QE_{egs}(t)/QT_{egs}(t)$$

$$XSH_{egs}(t-1) = QX_{es}(t-1)/QT_{egs}(t-1)$$

Thus, the entrant's market share is measured as a portion of production in the period of entry while the exiter's market share is measured as a portion of production in the period prior to exit. Relative size is calculated as follows:

$$ERS_{egs}(t) = \frac{QE_{egs}(t)/NE_{egs}(t)}{\left(QT_{egs}(t) - QE_{egs}(t)\right)/\left(NT_{egs}(t) - NE_{egs}(t)\right)}$$

$$XRS_{egs}(t-1) = \frac{QX_{egs}(t-1) / NE_{egs}(t-1)}{(QT_{egs}(t-1) - QX_{egs}(t-1)) / (NT_{egs}(t) - NX_{egs}(t-1))}$$

Market share and relative size are thus calculated relative to firm type. In the appendix, I provide a summary of these variables calculated with all firms as the base. The interpretations of the variables calculated in this manner changes considerably.

Entry and Exit Statistics

The first step in identifying patterns of entry and exit is to measure the levels of the entry variables over time. Tables 10 through 12 provide yearly means for ER, XR, ESH, XSH, ERS, and XRS at three different levels of entry analysis: owner, facility, and owner-facility. The yearly averages are constructed by calculating the variables as described above and averaging across the six permutations of governance structure and system membership. I first present market tabulations and then introduce the importance of governance structure and system membership.

The entry and exit variables for hospital firms summarized in table 10 are similar to other industries. Firm exit rate is consistently higher than entry rate. Between 1978 and 2000 only three years experienced positive net entry. After 2000, the number of firms in the market remains relatively constant. These entry rates are comparable to those calculated in Dunne et al.; however, they are below average rates across industries. Market share of entering and exiting firms is also significantly below average, ranging between .02 and .11 for entering firms and .01 to .09 for exiting firms. Both entrants and exciters are relatively smaller than survivors. This is consistent with the pattern that firms enter small and must grow to survive, however further evidence should be required to substantiate this claim. Section 5 investigates this issue further.

Entry and exit variables for hospital facilities are summarize in table 11. Facility entry and exit rates are much lower than firm entry and exit rates. The pattern in relative size of entry and exit rates of hospitals seems to be the inverse of firms. After the early 1990s, the gap between hospital exit and entry rate becomes larger rather than smaller. In addition, the early 1980s has large net entry of firms but relatively small net entry of hospitals. Firm entry follows significantly different patterns than facility and facility/firm entry.

The market share of entering and exiting hospitals is very small. In fact, for every year in the study period, entry and exit market share is smaller than that of all but one industry, tobacco, examined by Dunne et al. (1988).[7] Thus, on the state level, entry and exit play relatively small roles in the market. It is important to note that, while at the state level, entry and exit do not represent large portions of production, on the local level exit could have a significant effect on access to care.

Relative size of entering and exiting hospitals is much smaller than surviving hospitals. The average relative size of entrants is .29 and that of exiters is .28. This is significantly smaller than firms. Firms can enter the market by acquiring existing hospitals or constructing new hospitals. A firm that enters by acquiring an existing hospital can take advantage of preexisting human capital and hospital organization. Similarly, firms that exit by selling are likely more profitable or efficient than firms that

[7] Averaging over years results in exit and entrant shares (.01 and .01) for hospitals that are lower than tobacco firms (.03, .02).

exit by closing. The entry and exit figures provided in table 11 represent both firms that exit by closing facilities and facilities that closed but whose owners continue to operate elsewhere either do the moving or due to system membership.

Table 12 summarizes entry and exit variables of facility-owners. This version of the unit of observation provides the most instances of entry and exit in the data. Average entry and exit rates of facility-owners are higher than both facilities and owners. This is expected because if owner -facility exit occurs without hospital exit, an owner-facility entrance must have also occurred. Every year an average of 6.4% of hospitals change owners.

The relative size of facility-owner entrants and exiters is higher than both owner and facility entrants and exiters. Facility-owner entry is the only type of entry that involves both experienced owners and preexisting hospitals. This type of entry involves relatively little risk as entrants have information about their own capabilities, the characteristics of the market and a functioning operation.

Two possible explanations stand out for why relative size increases from hospitals to owners and from owners to owner entrants. The first is that as risk of failure reduces entrants are more willing to invest near the efficient scale. The second is that I are examining two significantly different types of entry, greenfield entry, when a new facility is opened, and brownfield entry, when a preexisting facility changes ownership.

Table 10: Entry and Exit Variables for Firms

Year	ER	XR	ESH	XSH	ERS	XRS
1977	0.09	0.03	0.08	0.01	0.75	0.11
1978	0.02	0.07	0.02	0.06	0.49	0.72
1979	0.04	0.04	0.02	0.04	0.32	0.67
1980	0.03	0.08	0.03	0.05	0.73	0.34
1981	0.03	0.08	0.02	0.07	0.73	0.74
1982	0.05	0.07	0.03	0.05	0.43	0.38
1983	0.06	0.08	0.05	0.05	0.64	0.54
1984	0.06	0.09	0.04	0.07	0.58	0.62
1985	0.04	0.05	0.05	0.03	0.67	0.30
1986	0.06	0.07	0.03	0.07	0.23	0.65
1987	0.06	0.08	0.06	0.04	0.58	0.44
1988	0.07	0.02	0.06	0.02	0.79	0.32
1989	0.04	0.05	0.04	0.03	0.41	0.38
1990	0.07	0.05	0.04	0.04	0.50	0.67
1991	0.07	0.09	0.03	0.04	0.43	0.54
1992	0.08	0.10	0.03	0.08	0.49	0.52
1993	0.06	0.07	0.04	0.07	0.36	0.82
1994	0.09	0.06	0.12	0.06	1.13	0.59
1995	0.04	0.09	0.02	0.08	0.40	0.49
1996	0.07	0.09	0.03	0.07	0.23	0.81
1997	0.08	0.08	0.02	0.05	0.29	0.42
1998	0.02	0.07	0.02	0.05	0.33	0.46
1999	0.06	0.08	0.03	0.03	0.35	0.30
2000	0.11	0.06	0.06	0.04	0.62	0.19
2001	0.06	0.05	0.02	0.04	0.16	0.39
2002	0.04	0.06	0.03	0.02	0.46	0.28
2003	0.02	0.09	0.01	0.03	0.48	0.18
2004	0.08	0.04	0.04	0.05	0.44	0.40
2005	0.08	0.04	0.06	0.02	0.38	0.42
2006	0.05	0.02	0.03	0.02	0.25	0.50
2007	0.03	0.04	0.03	0.03	1.05	0.51
2008	0.05	0.00	0.03	0.00	0.24	0.00
Mean	0.06	0.06	0.04	0.04	0.50	0.46

ER=Entry Rate
XR=Exit Rate
ESH=Entry Relative Share
ESH=Exit Relative Share
ERS=Entry Relative Size
XRS=Exit Relative Size

Table 11: Entry and Exit Variables for Facilities

Year	ER	XR	ESH	XSH	ERS	XRS
1977	0.01	0.02	0.00	0.00	0.16	0.10
1978	0.02	0.01	0.01	0.00	0.53	0.16
1979	0.01	0.02	0.00	0.02	0.06	0.70
1980	0.02	0.02	0.04	0.00	1.85	0.23
1981	0.02	0.01	0.01	0.00	0.22	0.12
1982	0.01	0.01	0.00	0.00	0.16	0.02
1983	0.01	0.02	0.00	0.01	0.08	0.16
1984	0.00	0.02	0.00	0.00	0.10	0.12
1985	0.02	0.01	0.01	0.00	0.27	0.16
1986	0.01	0.01	0.00	0.01	0.05	0.36
1987	0.01	0.02	0.01	0.01	0.30	0.18
1988	0.02	0.01	0.01	0.00	0.26	0.18
1989	0.03	0.03	0.00	0.01	0.13	0.35
1990	0.03	0.02	0.01	0.01	0.20	0.18
1991	0.05	0.03	0.01	0.01	0.29	0.23
1992	0.02	0.04	0.01	0.01	0.15	0.24
1993	0.01	0.03	0.00	0.01	0.10	0.14
1994	0.01	0.01	0.01	0.01	0.24	0.29
1995	0.01	0.05	0.00	0.02	0.04	0.21
1996	0.01	0.02	0.00	0.01	0.07	0.70
1997	0.02	0.05	0.00	0.02	0.11	0.43
1998	0.01	0.04	0.01	0.03	0.76	0.57
1999	0.01	0.05	0.02	0.02	1.36	0.41
2000	0.02	0.03	0.02	0.01	0.71	0.18
2001	0.00	0.02	0.00	0.01	0.06	0.52
2002	0.01	0.03	0.00	0.01	0.05	0.53
2003	0.01	0.03	0.01	0.01	0.44	0.25
2004	0.01	0.03	0.00	0.02	0.04	0.39
2005	0.01	0.01	0.01	0.00	0.13	0.06
2006	0.01	0.01	0.00	0.00	0.08	0.24
2007	0.01	0.03	0.00	0.02	0.03	0.53
2008	0.02	0.00	0.00	0.00	0.11	0.00
Mean	0.01	0.02	0.01	0.01	0.29	0.29

ER=Entry Rate
XR=Exit Rate
ESH=Entry Relative Share
ESH=Exit Relative Share
ERS=Entry Relative Size
XRS=Exit Relative Size

Table 12: Entry and Exit Variables for Firm/Facilities						
Year	ER	XR	ESH	XSH	ERS	XRS
1977	0.11	0.07	0.09	0.04	0.80	0.42
1978	0.05	0.09	0.03	0.07	0.50	0.64
1979	0.08	0.07	0.06	0.07	0.57	1.11
1980	0.07	0.08	0.09	0.07	1.14	0.65
1981	0.09	0.09	0.09	0.07	0.89	0.70
1982	0.06	0.10	0.04	0.08	0.58	0.96
1983	0.08	0.08	0.06	0.06	0.57	0.58
1984	0.08	0.10	0.05	0.08	0.76	0.70
1985	0.08	0.07	0.07	0.04	0.71	0.40
1986	0.07	0.08	0.03	0.08	0.31	0.73
1987	0.09	0.09	0.08	0.07	0.79	0.67
1988	0.10	0.03	0.07	0.03	0.71	0.60
1989	0.07	0.10	0.05	0.06	0.60	0.56
1990	0.09	0.07	0.06	0.06	0.70	0.75
1991	0.11	0.08	0.06	0.05	0.55	0.81
1992	0.07	0.12	0.04	0.09	0.59	0.59
1993	0.08	0.13	0.06	0.17	0.55	1.08
1994	0.14	0.08	0.17	0.07	0.91	0.72
1995	0.08	0.14	0.07	0.11	0.99	0.68
1996	0.09	0.11	0.07	0.11	0.52	1.10
1997	0.11	0.11	0.07	0.08	0.52	0.74
1998	0.04	0.09	0.06	0.07	1.10	0.70
1999	0.07	0.11	0.07	0.07	1.12	0.63
2000	0.08	0.09	0.08	0.05	0.96	0.34
2001	0.07	0.08	0.04	0.06	0.29	0.52
2002	0.06	0.05	0.04	0.03	0.51	0.59
2003	0.03	0.12	0.02	0.06	0.61	0.50
2004	0.08	0.14	0.06	0.11	0.58	0.65
2005	0.09	0.05	0.10	0.03	0.84	0.57
2006	0.06	0.05	0.04	0.05	0.50	0.93
2007	0.03	0.06	0.04	0.06	1.20	0.86
2008	0.08	0.09	0.06	0.07	0.71	0.69
Mean	0.08	0.09	0.06	0.07	0.71	0.69

ER=Entry Rate
XR=Exit Rate
ESH=Entry Relative Share
ESH=Exit Relative Share
ERS=Entry Relative Size
XRS=Exit Relative Size

Greenfield entry occurs when market has grown sufficiently to support entry by a new firm. In the presence of barriers to entry a threshold growth level must occur before a new firm finds it profitable to enter. In the presence of market power, entry occurs before the market size has grown sufficiently to support a new hospital at the minimum efficient scale.

Brownfield entry occurs when an entrant believes that they have a greater operating efficiency than the owner of a preexisting hospital. Brownfield entry thus occurs sometime after greenfield entry and thus after the market has grown beyond the entry threshold. It is likely that both explanations play a role in the observed increase in relative size.

Entry Type

To characterize patterns of entry among greenfield and brownfield entrants, I calculate the entry and exit variables using entry type rather than the governance system membership distinction. I divide facility-owner entries into four categories new firm new hospital (NF/NH), new firm old hospital (NF/OH), old firm new hospital (OF/NH), and old firm old hospital (OF/OH). In addition to summing across different criteria, I use a pooled denominator when calculating rates. The variables $QT(t)$ and $NT(t)$ represent the entire production and number of firms in Californian in time t. I use the same denominator for the different entry types for two reasons. First, the pool of entrants for new firms cannot be observed. Second, a single denominator will allow comparison of entry and exit variables across entry type.

Table 13 summarizes the mean entry and exit rates for across entry type. Note that because of the use of a pooled base, the interpretation of these variables differs from those presented earlier. Magnitudes of ER, XR, ESH, and XSH are smaller simply because the denominator includes the entire market. Furthermore, entry rates and entry shares are now higher on average than exit rates and exit shares.

The entry and exit rates for old hospitals are five to ten times that of new hospitals; however, old firms and new firms enter at similar rates. The mean entrant relative size for preexisting firms opening new facilities is greater than new firms opening new hospitals. Similarly mean entrant relative size for old firms purchasing old hospitals is larger than new firms purchasing old hospitals. This is consistent with the hypothesis that diversifying firms have lower risk than new firms. New and old firms entering with new hospitals are smaller than new and old firms entering with old hospitals.

Table 13: Mean Entry and Exit Variables by Entry Type

	NF/NH	NF/OH	DF/NH	DF/OH
ER	0.005	0.035	0.007	0.026
	(.004)	(.015)	(.006)	(.014)
XR	0.003	0.028	0.005	0.021
	(.003)	(.013)	(.006)	(.012)
ESH	0.001	0.02	0.004	0.019
	(.002)	(.012)	(.008)	(.014)
XSH	0.001	0.015	0.002	0.012
	(.001)	(.009)	(.005)	(.01)
ERS	0.158	0.562	0.463	0.695
	(.168)	(.245)	(.87)	(.398)
XRS	0.191	0.48	0.718	0.587
	(.211)	(.215)	(2.959)	(.623)

Standard deviation in parentheses

Both of these findings are consistent with my explanation of the increasing relative sizes reported in section 3.4.1. These findings suggest that there may be differences across governance structures in the decision of how to enter markets and that preexisting firms enter systematically different markets than new firms.

Governance Structure and System Membership

It is clear from section 3 that there are significant differences between hospitals of different governance structures and system memberships. In this section, I conduct a more detailed investigation of how entry and exit patterns differ between not-for-profit, for-profit and government hospitals for both system and single hospitals. I analyze the entry and exit variables using both pooled and unpooled denominators. The pooled variables will allow comparison relative to the market. From these variables, I draw conclusions regarding relative importance and size of the different hospital sectors. Hospital firms in different sectors appear to operate in fundamentally different ways. The variables calculated with unpooled denominators allow me to draw conclusions regarding these sectors that are independent of the relative importance of the sectors to the market as a whole.

Single plant firms enter and exit at a higher rate than multiplant firms. In fact, no government multiplant firm has entered the market since 1993. For-profit firms have strikingly high entry and exit rates. Between 2003 and 2008, forty for-profit single firms entered the market and the total number of for-profit single firms increased from 42 to 52 and 27 for-profit single firms survived from 2003. Between 2003 and 2008 the entry rate for for-profit firms was nearly 1, compared to an entry rate of .12 for single government and .16 for single not-for-profit firms in the same time period. This five year time period is calculated to provide comparison with Dunne *et al.* (1988), whose data is only available in 5 year increments. Note, however, that the data used by Dunne *et al.* does not identification of firms that enter then exit within a 5 year period. Ignoring entry and exit in the intervening years would lower my calculation of for-profit single firm entry rate from .95 to .19.

Table 14 summarizes mean yearly entry by governance structure and system membership. This provides strong evidence that single hospital owners from all three governance structures have average entry rates higher than their multiplant counterparts. For-profits experience relatively greater entry than nonprofits and nonprofits than government firms. For-profit hospitals change ownership more rapidly than other types of hospitals. This is consistent with the idea that not-for-profit firms are less sensitive to profit than for-profit firms.

Table 14: Means by Governance and System Membership

	Entry Rate		Entrant Market Share	
	Independent	System	Independent	System
Not-for-profit	0.05	0.03	0.03	0.01
	(.03)	(.03)	(.02)	(.02)
For Profit	0.14	0.08	0.11	0.04
	(.05)	(.09)	(.06)	(.07)
Government	0.04	0.01	0.02	0.01
	(.04)	(.02)	(.03)	(.01)

Standard deviation in parentheses

Post Entry Performance

The role of entry on market performance depends not simply the size and share of entrants. I turn now to firm performance in the years following entry. Previous entry literature supports a stylized fact that firms tend to enter markets below the minimum efficient scale and surviving entrants grow faster than incumbents. In the previous sections, I demonstrate that hospitals follow this pattern of relatively small entry size. These differences are persistent when limiting the data to short term general hospitals. To assess the post entry performance of firms I examine how the relative size of entrants changes over time, and how growth rates for surviving firms differ from exiting firms.

Table 15 reports the average relative size of entrants in the years following entry. Nearly all entry cohorts, 28 of 32, have relative size less than one. This means that the average size of an entry cohort is smaller than the average size of incumbent firms at the year of entry. The cohorts entering in 1979 and 1980 included several relatively large state hospitals. And consequently persist as outliers throughout the research period. There is no clear trend of increasing relative size. Dunne *et al.* (1988) find that entry cohorts consistently increase in relative size over time. This raises the question why is the hospital industry different? The evolution of relative size over time is similar across all governance structures. Results are also similar when basing entry on the facility level and the owner-facility level.

While entrants do not systematically grow in relative size, it is incorrect to assume that absolute growth is not a critical factor for entrants. Surviving firms have a significantly higher growth rate than failing firms. Table 16 presents the results of regressing growth rate of firms against a dummy variable marking exiting firms.[8] Firms

[8] The values of these means change slightly when examining only short-term general hospitals. However, the signs, significance, and significance of differences across governance structures remains.

that exit have significantly smaller growth rates than firms that survive. Similar results hold when comparing lagged growth rates.

These two findings paint a much different picture for the hospital market than the standard industry findings for post entry performance. Audresch and Mahmood (1993) characterize markets as having many small firms entering beneath a minimum efficient scale and relying on rapid growth to achieve a competitive size, resulting in a skewed distribution of firm size. The hospital market also has a skewed distribution of firm size. However, I find that entrants do not necessarily outgrow incumbents. None-the-less, firms that fail to grow are more prone to exit.

Not-for-profit and government firms have similar growth rates; however, for-profits have significantly larger growth rates than not-for-profit. Not-for-profit and for-profit firms that fail have significantly lower growth rates than firms that survive. Multiplant firms grow at a much faster rate than single plant firms. Multiplant firms that exit have significantly lower growth rates than multiplant firms that survive.

Conclusions

This paper has identified numerous striking patterns in Californian hospitals. These are of interest for two reasons. First they provide a service industry counterpart to existing information on manufacturing industries. Second, they identify important directions for future research on hospital markets.

Table 15: Relative Size of Entry Cohort

Cohort entry year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993-2008
Pre-existing Firm	1.00	0.98	0.95	0.90	0.89	0.88	0.87	0.87	0.86	0.84	0.83	0.83	0.83	0.86	0.88	0.88	0.85	
1977		0.40	1.74	0.48	0.50	0.47	0.45	0.45	0.44	0.45	0.44	0.46	0.48	0.50	0.53	0.56	0.56	
1978			0.24	0.34	0.33	0.27	0.26	0.25	0.24	0.26	0.30	0.34	0.38	0.40	0.41	0.39	0.36	
1979				8.47	4.47	4.56	4.72	5.22	5.73	6.02	6.00	5.90	6.19	0.63	1.68	2.53	3.18	
1980					2.52	2.43	2.54	2.69	2.78	2.82	2.86	2.74	2.77	3.22	1.00	1.23	1.56	
1981						0.05	0.04	0.05	0.01	0.01	0.05	0.06	0.06	0.05	0.09	0.08	0.06	
1982							0.25	0.33	0.35	0.35	0.32	0.30	0.26	0.22	0.19	0.17	0.16	
1983								0.15	0.22	0.26	0.27	0.28	0.30	0.30	0.27	0.26	0.25	
1984									0.10	0.11	0.11	0.12	0.12	0.12	0.13	0.13	0.12	
1985										0.13	0.13	0.14	0.14	0.14	0.13	0.14	0.10	
1986											0.05	0.06	0.07	0.07	0.06	0.04	0.04	
1987												0.47	0.50	0.52	0.52	0.51	0.49	
1988													0.16	0.19	0.18	0.15	0.15	
1989														0.18	0.17	0.20	0.21	
1990															0.23	0.25	0.25	
1991																0.14	0.17	
1992																	0.41	

Table 15: (extended)

Cohort entry year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Pre-existing Firm	0.84	0.78	0.77	0.75	0.75	0.72	0.67	0.64	0.62	0.62	0.59	0.57	0.56	0.55	0.55	0.56
1977	0.59	0.46	0.46	0.45	0.44	0.43	0.43	0.43	0.44	0.41	0.41	0.41	0.41	0.41	0.42	0.44
1978	0.34	0.30	0.30	0.29	0.30	0.30	0.29	0.29	0.28	0.29	0.22	0.29	0.30	0.31	0.31	0.31
1979	2.25	5.97	5.62	4.95	5.41	5.30	6.19	6.31	6.32	6.59	6.34	6.55	6.18	6.31	5.65	5.98
1980	1.73	3.17	2.83	2.84	2.45	2.30	2.65	2.75	2.88	2.79	3.63	3.99	4.04	4.27	4.14	3.91
1981	0.05															
1982	0.11	0.10	0.09	0.04	0.04	0.04	0.03	0.03								
1983	0.22	0.20	0.20	0.18	0.18	0.17	0.17	0.18	0.19	0.19	0.18	0.16	0.16	0.17	0.17	0.15
1984	0.12	0.10	0.10	0.10	0.11	0.10	0.10	0.10	0.11	0.12	0.12	0.11	0.11	0.11	0.11	0.10
1985	0.09	0.07	0.05	0.04	0.05	0.05	0.05	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02
1986	0.05	0.05	0.06	0.24	0.21	0.18	0.16	0.19	0.24	0.22	0.22	0.23	0.26	0.29	0.31	0.31
1987	0.47	0.42	0.40	0.36	0.36	0.33	0.31	0.29	0.28	0.29	0.27	0.26	0.23	0.22	0.21	0.21
1988	0.14	0.12	0.09	0.10	0.10	0.09	0.09	0.08	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06
1989	0.18	0.15	0.15	0.13	0.16	0.11	0.11	0.09	0.08	0.07	0.07	0.07	0.07	0.08	0.08	0.07
1990	0.24	0.21	0.20	0.19	0.19	0.18	0.15	0.13	0.13	0.13	0.12	0.11	0.09	0.09	0.09	0.09
1991	0.19	0.19	0.19	0.18	0.19	0.19	0.18	0.18	0.19	0.20	0.18	0.15	0.15	0.15	0.13	0.13
1992	0.21	0.45	0.45	0.44	0.47	0.57	0.50	0.43	0.45	0.55	0.59	0.61	0.61	0.63	0.67	0.71
1993	0.15	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.11
1994		0.33	0.45	0.42	0.27	0.25	0.23	0.22	0.22	0.23	0.24	0.25	0.27	0.27	0.26	0.26
1995			0.01	0.03	0.03	0.02	0.02	0.04	0.03	0.02	0.02	0.02	0.02	0.03	0.01	0.01
1996				0.22	0.21	0.22	0.21	0.20	0.18	0.19	0.19	0.20	0.24	0.27	0.28	0.28
1997					0.10	0.12	0.12	0.12	0.12	0.12	0.10	0.09	0.10	0.09	0.08	0.08
1998						0.67	0.67	0.67	0.62	0.62	0.58	0.61	0.58	0.48	0.46	0.45
1999							2.67	2.63	2.48	2.41	2.33	2.30	2.27	2.19	2.11	2.06
2000								0.45	0.45	0.48	0.49	0.50	0.49	0.50	0.53	0.53

Table 15: (continued)

2001	0.13	0.16	0.16	0.17	0.18	0.16	0.16	0.13
2002								
2003			0.20	0.16	0.17	0.19	0.20	0.22
2004				0.13	0.16	0.17	0.18	0.18
2005					0.04	0.09	0.11	0.11
2006						0.45	0.28	0.20
2007							0.02	0.02
2008								0.19

Table 16: Mean Growth Rates by Governance and Survival

VARIABLES	(1) Owner Growth	(2) Facility Growth	(3) Owner-Facility Growth
NPExit	-0.0863*	-0.3	-0.0530***
	(0.05)	(1.26)	(0.01)
FPExit	-0.166***	-0.2	-0.0951***
	(0.05)	(1.03)	(0.01)
GOVExit	-0.11	-0.47	-0.0780***
	(0.11)	(1.64)	(0.03)
NP	0.0744***	0.21	0.0442***
	(0.01)	(0.14)	(.000)
FP	0.123***	0.06	0.0596***
	(0.02)	(0.18)	(.000)
GOV	0.0766***	0.409*	0.0430***
	(0.02)	(0.21)	(0.01)
Observations	7000	14695	11961
R-squared	0.02	0	0.03
NP=FP F	5.45	0.44	7.57
NP=FP Prob>F	0.02	0.51	0.01
NP-NPExit=FP-FPExit F	2.8	0.02	8.13
NP-NPExit=FP-FPExit Prob>F	0.09	0.88	0

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The examination of basic trends regarding the number, size, utilization and profitability of different types of hospitals provides significant insight into the evolution of the hospital market. Over the last 30 years, there has been a constant decline in Californian hospitals and an increase in the concentration of hospital firms. This period also experienced a switch from net losses to net gains. However, these changes were not consistent across either governance structure or system membership. Nonprofit hospitals and system affiliated hospitals tend to fair better over the study period, and nonprofit system hospitals in particular grew in both number and profitability over the entire period. Because declines in one type of firm are matched with increases of other types of firms the data suggest there is an underlying process relating exiting firms to entering firms. Three potential hypotheses to explore are:

- Hospitals switch governance or system membership to survive,
- Firms seeking to expand target particular types of hospitals, or
- Exit is occurring in different submarkets than entry.

The most striking exit trend in California revolves around government system hospitals. Government system hospitals decrease from a high of 56 in 1995 to a low of 14 in 2007. The data indicate that government system hospitals serve a distinct segment of the hospital market. What is the reason for this 75% reduction in hospitals and what is the impact of this reduction on both the remaining hospitals and on Californian residents?

The hospital market mirrors some well-established patterns of manufacturing industries, but there are also a number of important differences. Entry and exit in hospital markets by firms occur with similar frequency as other industries. Facilities, on the other hand, have exceptionally low entry and exit rates. Despite this I still observe a significant decline in the number of hospital facilities over the study period. While nonprofit and system hospitals appear to perform better over the study period, for-profit and system hospitals actually enter and exit at a higher rate.

Within other industries high turnover is thought to be related to technological innovation and the product lifecycle. The study period is associated with significant technological innovation in the hospital industry. If current literature on product lifecycle and technological innovation is accepted, it must be concluded that hospitals of different governance structures are at different stages in the product lifecycle and that technological innovation is generated and disseminated in different ways for each permutation of governance and system membership.

Alternately, service industries and hospitals may experience technological innovation in a different manner than manufacturing industries. This points to yet another direction that has seen little research by economists; technological innovation in service industries.

Dunne et al. (1988) distinguish between new plant and old plant diversification, but this distinction refers to the use of a previously owned plant or the use of a newly owned plant. It does not identify whether entry occurs via construction or acquisition. Because of this they fail to differentiate between non-diversifying entrants who enter via new plants from non-diversifying entrants who enter through old plants. Within the hospital industry this distinction is particularly important. Market entry involving either pre-existing hospitals or pre-existing firms involves significantly greater entry size and market share. Unlike Dunne et al. (1988) and Geroski (1995), who found that new firms enter at a greater rate than old firms, new hospital firms and old hospital firms enter and exit at similar rates. However, new firms establishing new hospitals enter with extremely small relative size, while diversifying firms establishing new hospitals enter with relatively larger sizes.

The post entry performance of hospitals does not follow that of other industries. For most industries firms enter relatively small and over time surviving firms grow rapidly to approach the relative size of incumbents. Surviving hospitals on the other hand appear to grow at similar rates regardless of age. Thus, I extend Audretsch et al.'s (2004) finding that Gibrat's law holds for small scale services to the hospital industry, a relatively large scale service industry.

The patterns documented in this paper identify a broad spectrum of areas in which hospitals differ from other industries. Each of these issues represents important directions for future research. Further, these differences reveal that standard approaches to modeling entry and exit will not adequately identify hospital behavior.

CHAPTER IV

ENTRY ATTRIBUTES, FIRM EXIT, AND SURVIVAL IN THE HOSPITAL INDUSTRY

Entry, exit, and industry evolution comprise one of the most significant topics in the study of industrial organization. Firm entry and exit are key factors in the efficiency of markets. Previous work in this area, including the work presented earlier in this volume, has identified a number of common patterns in how firms enter and exit markets. However, the mechanisms underlying these patterns remain unclear. Much of the recent entry literature models entry, exit and industry evolution as a story of technological innovation and competition amongst incumbent firms and potential entrants (Siegfried and Evans 1994). The success of entrants is hypothesized to depend on individual firm characteristics (Jovanovic 1982, Dunne et al. 2005, Ciliberto and Lindrooth 2007, Cabral 1995, Mata Portugal Guimaraes 1995. Farinas Ruano 2005, Darhoff Stahl Woywode 1998, Audretsch Mahmood 1995, Chakravarty et al. 2006 Deily McKay Dorner 2000, Harrison Laincz 2008), market characteristics such as technological intensity or life cycle stage (Klepper 2002, Agarwal and Audrestch 2001, Agarwal and Gort 1996, Agarwal 1998, Audrestch 1991, Audretsch Mahmood 1995, Klepper 1996, Klepper and Miller 1995) and the post entry success of the firm increasing efficiency (Klepper 2002, Hopenhayn 1992, and Ericson and Pakes 1995). While these models have been successful in explaining the relationship between entry characteristics and exit behavior of firms, they fail to explain why firms enter with heterogeneous size.

The research finds that entry capacity is positively related to firm survival. This finding is consistent across industries and governance structures. The majority of this research refers to Jovanovic's (1982) model of uncertain costs and firm specific efficiency. In this model, firms enter with identical beliefs regarding efficiency and update their beliefs after observing each period's costs. This results in some firms discovering that they entered too small and some discovering that they entered too large. However it implies that all firms enter with the same size in the initial period. This paper makes a closer examination of the entry and exit models proposed by Jovanovic (1982) and Ericson and Pakes (1995) and explores the implications of heterogeneous pre-entry beliefs, pre-entry experience, firm objective, and capacity adjustment costs.

The assumption that entrants have identical beliefs before entering a market is highly unrealistic. Indeed, one of the difficulties in the empirical analysis of firm entry is sample selection bias. Firms that chose to enter have higher expected profits than firms than potential entrants that chose not to enter. Entrants differ with regards to latent efficiency and beliefs regarding latent efficiency. Accounting for heterogeneous prior efficiency beliefs results in firms entering with heterogeneous entry size. Heterogeneous entry size in turn affects firm survival rates, with survival increasing in efficiency and accuracy of efficiency beliefs.

Econometric analysis financial data from the California hospital market provides strong evidence supporting the predictions of this chapter's model. The previous work in this volume demonstrates that the California hospital market has experienced significant entry and exit over the last 30 years. The first empirical analysis is a logit model of exit. I find that the hazard rate diminishes with entry capacity. Firms that enter with no prior experience in the hospital market and firms that enter by constructing a new facility rather than acquiring a preexisting hospital facility also have a reduced hazard of exit.

However the roll of entry capacity varies systematically with both governance structure and entry experience and the role of entry experience varies systematically with governance structure. The second empirical analysis explores the relationship between firm growth and entry experience.

Background

Early studies on firm entry and evolution were limited by availability of firm level data. However, as more detailed data became available a significant number of unexpected patterns emerged regarding entry, growth and exit. Among these was the observation that firms tend to enter markets small and that small firms grew faster than large firms. This contradicts Gibrat's longstanding law of proportional growth.

A seminal study by Jovanovic (1982) explained deviations from Gibrats law through firm entry dynamics. Jovanovic proposed that firms enter markets with some uncertainty regarding their own efficiency. Firms enter believing that their efficiency is average. As firms gain operating experience they receive signals regarding their efficiency. Efficient firms grow more rapidly than incumbents to achieve the optimal operating scale, while underperforming firms grow slowly and ultimately chose to exit the market.

Following Jovanovic, numerous firm level empirical studies of entry and exit were published, building a picture of firm entry and industry evolution. The comprehensive reviews of the literature provided by Geroski (1995) and Siegfried and Evans (1994) summarize the findings of the literature and propose numerous stylized facts and results regarding entry and exit. These findings, as well as those in the previous two chapters, motivate the model presented in this paper.

While most firms enter small, there is significant heterogeneity in relative entry size. The entry size of a firm is positively related to firm survival (Audretsch and Mahmood 1995 and Agarwal and Audretsch 2001[9], Evans (1987), Dunne et al. (1989), Levinsohn and Petropoulos (2000), and Bernard and Jensen (2002)). Diversifying firms tend to enter new markets with larger capacity and market share than new firms. Dunne et al. (1988) finds that diversifying firms entering with a new plant actually enter larger than diversifying firms entering with a preexisting plant. This finding is due to their method of identifying new and old plants. None of the reviewed entry literature differentiates between the acquisition of a preexisting plant and the construction of a new plant. Chapter III above demonstrates that new plants tend to be smaller in scale than old plants.

Klepper (2002), Dunne et al. (2005) and Mata et al. (1995) use the relationship between entry size and firm experience to motivate empirical work relating firm experience to firm survival. Each study provides different conclusions regarding the role of experience in firm survival. Klepper (2002) studied four important manufacturing industries that evolved into oligopolies over the course of the 20th century. The role of experience differed for each industry, and each industry experienced entrants were associated with lower hazard rates. Dunne et al. (2005) expands the concept of

[9] Agarwal and Audretsch (2001) actually identify two subgroups that experience relatively small advantages from entry size: mature industries and technologically intensive industries. The consolidation presented in Chapter III suggests that the hospital industry is transitioning towards maturity. The past two decades has also seen a significant increase in the technological intencity of the hospital industry.

experience to apply to both the firm and the manufacturing facility. They find three distinct combinations of plant and firm experience that lead to distinct exit patterns. Experienced firms entering with experienced[10] plants exit quickest followed by new firms operating new plants and experienced firms operating new plants. However, the difference in survival between the last two categories was not significant. Mata et al. (1995) find that new firm entrants actually have a higher probability of surviving than experienced plants. Further, they find that initial size is more important for de novo entrants than experienced entrants. Mata et al. provide relatively little intuition for the higher survival rate of de novo entrants.

Klepper's (2002) theoretical treatment of entry assumes full information prior to entry. Low productivity firms rationally enter early in the product lifecycle because prices are high. However, as firms accumulate research and development efficient firms benefit from more substantial decreases in marginal cost. Because of this low efficiency firms are forced out of the market. Experienced firms are all assumed to be high productivity. To my knowledge, the only theoretical treatment of heterogeneous uncertain entry is Cabral's (1995) model of sunk cost and firm growth. Cabral demonstrates that if costs are sunk and firms observe a signal regarding efficiency prior to investing in capacity than firms with more advantageous signals enter with larger capacity. However, the model is highly stylized, relaxing the assumptions on firm costs results in an ambiguous relationship between efficiency and entry size.

[10] As noted above, Dunne et al. (1988; 2005) categorizes experienced firms operating experienced plants as experienced firms diversifying plants that they already own. The relatively high entry and exit could be driven by the low cost of entry and exit or firms choosing diversification for markets that have higher uncertainty.

While these authors demonstrate that entrant experience is a significant factor in firm survival they fail to explain why firms of equivalent experience have variation in entry size. The key insights of previous work that drive the model below are that sunk costs in the presence of uncertainty influence firm entry size and that firm experience can play a key indicator of productivity. Unlike current models of uncertain efficiency in which entering firms have identical beliefs regarding the profitability of markets, this model proposes that entering firms receive a signal with noise regarding efficiency prior to choosing entry capacity. Firms with more advantageous signals face smaller risk of failure. Because firm failure is associated with a loss of sunk costs firms with advantageous signals chose to enter with greater capacity.

Firm Entry and Survival Model

The empirical work summarized above identifies entry capacity as an important factor in firm survival but fails to identify why firms have heterogeneous entry size. I propose that a key factor driving heterogeneity in entry decisions and post-entry performance is expected productivity and the degree of uncertainty involved in predicting productivity. This model extends Jovanovic's (1982) model of noisy selection in a number of directions. I allow firms to have fuzzy knowledge of individual productivity prior to making entry decisions. Because entering firms are heterogeneous, I treat entry with a greater level of attention. To maintain consistency with the previous two chapters I base firm decisions on independent firm objective functions. This last modification is motivated by two observations. Chapter II provides evidence that not all firms share the same objective of profit maximization. Chapter III indicates that governance structure may be related to firm exit decisions.

The model is developed in stages. First, I identify firm objectives and the relationship between governance structure and objective. Second, I develop the model of capacity and exit under the assumption of no sunk costs. I then extend the model to allow for sunk costs. Finally, before proceeding to the empirical analysis of the model, I introduce two secondary sources of uncertainty: plant level productivity and market demand.

Firm Objectives

This section establishes a basis for modeling firm objectives in a manner that is consistent with the previous two chapters. Standard economic models of firms assume that firm decisions are based on the objective of maximizing profits. While preference maximization is a reasonable primitive assumption for consumer behavior, it is not held as a primitive concept for firms (Mas-Colell, Whinston and Green, 1995). The fundamental argument for assuming firms maximize profits is straight forward under the assumption of complete and competitive markets. If prices are fixed, maximizing income is akin to maximizing preferences. However, as the theorist moves away from the idealized world and towards the actual world this simple outcome is no longer valid.

Thornton and Eakin (1992) provide a general theory of firm owners with non-monetary objectives. They show that owners absorb the discrepancy between the market value of assets and owner's value as a shadow cost of achieving the non-monetary objectives. This "virtual price" allows a tractable solution to the owner's optimization problem.

The virtual price can be formulated as the difference between actual return on investment and maximal return on investment. I represent heterogeneity in firm objectives as heterogeneity in required rate of return for capital. The literature on hospital objectives posits two objectives that may result in a failure to maximize profit. The more altruistic objective is welfare maximization. A second objective, and one that proves more tractable for my model, is employee welfare maximization. Under employee welfare maximization employee extract rents from hospitals through greater than market wages. This results in a quantity choice that is similar to profit maximization. In monopolistically competitive markets, there is a direct tradeoff between return on investment and these alternate objectives.

The nonprofit literature suggests that choosing a nonprofit governance structure lowers the marginal cost of non-monetary objectives. It is generally accepted that non-profit and government owned firms are more likely to pursue non-monetary objectives than for profit firms. One of the simplifying assumptions that I make is that entrepreneurs self-select into firm governance structures based on their required rate of return. Rather than basing firm decisions on a vector of outcomes covering multiple firm objectives firms chose a quantity to maximize profit subject to a minimum required return on capital.

Not-for-profit hospitals remain in less profitable markets longer than for profit hospitals. One common explanation for this is that a major non-monetary objective is access to care. Increasing access to care beyond the profit maximizing level could result from operating at a size beyond the profit maximizing size to serve markets that are large or operating at size smaller than the profit maximizing to serve markets that are small. Both choices would lead to lower returns on investment.

This decision process is consistent with observed firm behavior. Firms of all governance structures price services above marginal cost. In general for-profit firms display the greatest markup ratios while government firms display the smallest markup ratios (see Chapter II). Furthermore, not-for-profit and government firms of similar types have wider size distributions, with more small and large hospitals than for profits. By segregating non-monetary objectives into required rate of return I can confine the heterogeneity in firm behavior to entry and exit decision. This simplifies the operating behavior of firms to be effectively focused on profit maximization. Modeling not-for-profit and government firms as profit maximizing may appear inconsistent with the arguments presented in this section and the previous chapters. However, it is consistent with the proposition of employee rent extraction and allowing for lower return on capitals, effectively increases the quantity of hospital service provided and thus social welfare. This approach is also consistent with a qualitative view of non-monetary objectives.

Chapter II demonstrates that the markup ratio, and consequently firm profit, is increasing with the weight that the firm places on profit over social welfare. The econometric analysis in Chapter II provides evidence that government, not-for-profit, and for profit firms have progressively higher markup ratios. In the analysis below, I assume that government, not-for-profit, and for profit firms have progressively increasing discount rates of $\delta_g < \delta_{np} < \delta_{fp}$. This assumption is consistent with both the econometric evidence already presented, and the empirical work presented in this chapter.

Productivity

An important factor in the profitability and survival of firms is productivity. Jovanovic (1982) and Ericson and Pakes (1995) both specify productivity as a firm specific attribute drawn from a known distribution. In this model, I extend productivity along two dimensions. First, I propose that firms have fuzzy knowledge of productivity prior to the commitment of large fixed costs. Second, I propose that productivity is both firm and market specific. The introduction of the second extension is delayed until after the model is fully developed and made primarily to motivate the empirical analysis.

Firms are started and managed by people and no two people or groups of people are identical. Differences in managerial skills, technical expertise, trade and professional networks and even political connections manifest within firms as differences in operating costs, market price and ultimately as differences in profit. However, many unknown factors prevent a clear understanding of the relationship between a firm or potential firm's observable characteristics and potential profit.

Partners and co-owners as well as employees may misrepresent their skills to personal advantage. Ego-guarding or self-deprecation may even result in misrepresentation of self-skills and characteristics. Even perfect information regarding the skills and abilities of individuals involved within a business does provide perfect insight into firm profitability. Every market, and in fact every firm, faces unique challenges in bringing a product to market and successfully transacting with customers.

In monopolistically competitive market consumer preference itself affects the profitability of a firm's particular permutation of the product.

Many of the attributes that contribute to firm productivity are evident prior to operating in a market. Thus it is likely that new firms can estimate productivity prior to entry. However, other factors influencing firm productivity are not observable and must be deduced from actual market performance. As firms gain experience with a market, observing both cost and profitability, they receive further signals regarding their individual productivity.

I model firm knowledge of productivity as a series of signals received prior to each round of market participation. Every firm has a latent level of efficiency E_f. In the first stage of round *t* the firm receives a signal $X_{ft} \sim N(E_f, \sigma_f)$. The signal can be decomposed into true efficiency and signal error, or $X_{ft} = E_f + \varepsilon_{ft}$ with $\varepsilon_{ft} \sim N(0, \sigma_f)$. For new firms the intuitive interpretation of this signal is based on entrepreneur and market characteristics. The intuitive interpretation for incumbent firms is experience gained in the previous round. The efficient estimate of E_f is $\{\sum_{t=1}^{n} X_{ft}\}/n = \overline{X_f}$ with standard deviation $\sigma_f/\sqrt{n}$. As firms gain market experience estimated efficiency converges on the true value and the variance of estimated efficiency diminishes. Diversifying firms have received more efficiency signals than new firms and consequently have a more accurate estimate of efficiency.

<u>Production</u>

Let $\pi(d_{ft}, c_{ft}, E_f, \varepsilon_{ft})$ be the maximum profits earned by firm f in period t where d_{ft} is a vector of parameters characterizing the residual market demand that firm f

faces and c_{ft} is the firm's capacity. The residual demand function represents the demand curve that the firm faces, accounting for the output of other firms in the market. In a monopoly setting the residual demand is also the market demand. The signal error ε_{ft} is included in the profit function to prevent firms from deriving E_f through observation of profit. Two possible interpretations of ε_{ft} are as a firm specific cost shock or a firm specific demand shock.

Capacity is the primary choice variable of the firm. Insufficient capacity restricts output and results in higher operating costs. Excess capacity reduces return on investment and requires higher maintenance costs. The optimal level of capacity, c_{ft}^*, depends on the firm's particular level of d_{ft} and E_f. Optimal capacity increase with both residual demand and firm efficiency. The relationship between optimal capacity, residual demand and firm efficiency is given by $c_{ft}^* = c_f^*(d_{ft}, E_f)$. Conditional on the firm operating at optimal capacity, profits are taken to be increasing in the size of the market and firm efficiency.

Hospital capacity has been demonstrated to play an important role in health outcomes (Matsuo et al. 2000) and hospital profitability (Harper 2002). Profitability is restricted by insufficient capacity due as a result of higher operating costs and lower total volume of services provided. Profitability is restricted by excess capacity due to excess capital costs and lower prices (Harper 2000).

If costs are not sunk then firms are free to adjust capacity each period to reflect current beliefs regarding firm efficiency and market demand. Investment in capacity is returned upon reduction in capacity and result in an equivalent increase of the firm's scrap value. If the firm choses to operate it must be the case that the investment in capacity earned returns equal to or higher than the firm's discount rate. Thus regardless of expectations about future periods if the firm choses to operate in the current period the firm selects an operating capacity based on known residual demand and expected firm efficiency $\overline{X_{ft}}$, or $c_f^*(d_{ft}, \overline{X_{ft}})$. The expected value of profit in any future period $t + j$ is $E\left[\pi\left(d_{ft+j}, c_{ft+j}^*, E_f\right)\right] = \pi^e\left(d_{ft+j}, c_{ft+j}^*(d_{ft+j}, \overline{X_{ft}}), \overline{X_{ft}}\right)$.The firm will chose to operate if the net present value of expected future profits is greater that the firm's scrap value: $\frac{\sum_{j=0}^{\infty} \pi^e\left(d_{ft+j}, c_{ft+j}^*, \overline{X_{ft}}\right)}{(1+\delta)^j} > s_t$. Because c_{ft}^* is increasing in $\overline{X_{ft}}$ and $\pi(\cdot)$ is increasing in both c_{it}^* and $\overline{X_{ft}}$ there must be some critical level of $\overline{X_{ft}}$ denoted $\widehat{\overline{X_{ft}}}$ such that all firms with $\overline{X_{ft}} > \widehat{\overline{X_{ft}}}$ will chose to operate.

Consider the evolution of a cohort of entrants facing constant residual demand. Firms will enter if $\overline{X_{ft}} > \widehat{\overline{X_f}}$, or $E_f + \overline{\varepsilon_{ft}} > \widehat{\overline{X_f}}$. Some firms with $E_f > \widehat{\overline{X_{f0}}}$ will fail to enter while some firms with $E_f < \widehat{\overline{X_f}}$ will erroneously enter. The estimated estimate of firm efficiency conditional on entry is positively biased. Because $\overline{X_{ft}}$ is continually distributed c_{ft} will also be continually distributed and bounded below by $c_f^*(d_f, \widehat{\overline{X_f}})$. Each period firms remaining in the cohort receive a new signal. Firms receiving signals smaller than prior productivity estimates will reduce capacity while firms receiving signals larger than prior productivity estimates grow. If the new signal is sufficiently small the firm will chose to exit $\frac{X_{ft+1}}{n} < \widehat{\overline{X_f}} - \overline{X_{ft}} * \frac{n-1}{n}$, alternately $\frac{\varepsilon_{ft+1}}{n} < \widehat{\overline{X_f}} - E_f - \overline{\epsilon_{ft}} * \frac{n-1}{n}$. As n increases, the weight placed on the new signal diminishes, thus older firms are less likely to exit. Firms with lower levels of $\overline{X_{ft-1}}$ and lower levels of E_f will be more likely to exit. Firms with high average signal error are more likely to exit.

The average value of E_f for the cohort increases over time as a greater portion of firms with low levels of E_f exit. However, $\overline{X_{ft}}$ converges to E_f, firms that initially overestimated efficiency revise beliefs, and subsequently capacity down, while firms that underestimated efficiency revise capacity up. , the residual demand that the firm faces may also change over time.

Allowing residual demand to vary over time enriches the possible dynamics of firm size and survival. Increasing residual demand increases optimal capacity. As efficient firms increase capacity, and subsequently quantity, residual demand for inefficient firms decreases, increasing the exit rate of inefficient firms. Factors affecting residual demand could include the number of firms in the market, the population, available substitutes and for the hospital industry, the general health of the population. If residual demand is growing via firm exit and population growth then firm size would trend up over time.

Table 17 compares the age of exiting hospital firms with a simulation of the model above using 100,000 firms with random samples of $E_f \sim N(0,1)$ and $X_{ft} \sim N(E_f, 1)$. Exit is based on the rule $\widehat{\overline{X_f}} < .95$. The exit percentage is calculated with firms that entered before 2000 and exited during the study period. The data are trimmed in this way guarantee that the data do not contain censored exit or entry. Exit percentage is calculated by dividing the number of firms that exited the market at a particular age divided by the number of firms in the trimmed data.

Table 17: Exit Rate by Age		
Age	Simulated Exit	Actual Exit
1	0.257	0.241
2	0.122	0.155
3	0.078	0.081
4	0.052	0.067
5	0.040	0.030
6	0.033	0.034
7	0.025	0.027
8	0.022	0.032
9	0.019	0.027
10	0.017	0.027

Introducing sunkness of cost increases the significance of efficiency uncertainty. Capacity investments have a cost of $v(c_{ft}, c_{ft-1})$, while capacity reduction returns $r(c_{ft}, c_{ft-1})$ with $r(c_{ft}, c_{ft-1}) < v(c_{ft}, c_{ft-1})$. The firm's maximization problem is now considerably more complex because it must now base the choice of c_{it} on its expectations of future capacity changes, which in turn depend on both demand expectations and productivity signals.

Overestimating optimal capacity imposes an additional cost that increases with the degree of sunkness. Suppose residual demand remains constant, so that $c_{ft}^* = c_f^*$. If the firm over invests in capacity the first period by Δc with $c_{f0}^o = c_f^* + \Delta c > c_f^*$ and corrects this the next period it incurs the additional cost $v(c_{f0}^o, 0) - v(c_f^*, 0) - \frac{r(c_{f0}^o, c_f^*)}{1+\delta} + \pi(d_f, c_f^*, E_f, \varepsilon_{ft}) - \pi(d_f, c_{f0}^o, E_f, \varepsilon_{ft})$. If the firm underinvests in capacity by

Δc with $c_{f0}^{u} = c_f^* - \Delta c > c_f^*$ and corrects this the next period the firm incurs additional costs of $v\left(c_{f0}^{o}, 0\right) + \frac{v\left(c_f^*, c_{f0}^{o}\right)}{1+\delta} - v\left(c_f^*\right) + \pi\left(d_f, c_f^*, E_f, \varepsilon_{ft}\right) - \pi\left(d_f, c_{ft}^{u}, E_f, \varepsilon_{ft}\right)$.

These costs can be decomposed into two parts, excess capacity change costs and operating profit costs. The capacity change costs from over investing depends on the difference between the cost to increase capacity and the value regained from decreasing capacity. In the case of hospitals, decreasing capacity may consist of closing a wing or floor, which essentially returns no value. The capacity change costs from under investing depend on the concavity of the capacity investment function. If there are constant returns to scale in capacity investment the capacity change costs from under investing are negative due to discounting. Increasing returns to scale is a more reasonable assumption, and leads firms to incorporate future increases in optimal capacity into the current capacity choice.

Data

The predictions of this model are compared to statistical results using a 33 year panel from Californian hospitals. The two sources used in constructing this panel come from California's Office of Statewide Health Planning and Development (OSHPD) Annual Hospital Financial Data and the Bureau of Economic Analysis. The description of the Annual Hospital Financial Data and its construction into a useable panel is located in section 3.3 above. County population and personal income, both provided by BEA, are included in the panel to control for variations in demand.

The unit of observation is an owner operating a hospital in a given year. Capacity is defined as the number of licensed hospital beds for a given hospital. Market exit occurs when a hospital changes owners or when a hospital ceases to provide service. Because this study is interested in firm efficiency it is necessary to focus on the exit of firms rather than the exit of facilities. Experience at entry is measured in several ways. The first is the number of years the firm has operated. The second is the number of hospitals that the firm operates. The third is the preexistence of the firm prior to entry. The last measure of experience is the preexistence of the hospital prior to entry. The preexistence of the firm prior to entry is implied by strictly positive years of experience prior to entry. However, this analysis distinguishes between the two to allow for a richer interaction between experience and survival.

A graphical overview of firm survival patterns is presented in figures 15 through 17.[11] The survival rate in year *t* is the percentage of entrents of a particular type operating after *t* years in the market. Contrary to expectations, the survival of new firms is similar to survival of preexisting firms and the survival rate of new hospitals is actually higher than the survival rate for old hospitals. Not-for-profit firms have a lower survival rate than government owned firms, and for profit firms have a lower survival rate than both government and not-for-profit firms. This is consistent with the assumption that required rate of return is related to profit status. These figures do not account for the fact that firms of different types enter with different capacity. Figure 15 shows an inverted u

[11] A new firm is defined as a firm that was not observed in the data set prior entering a speficic hospital market. A pre-existing or encombant firm is a firm that operated in another Californian hospital market in prior years. Note that under this definition new firms may include firms that existed prior to entry but operated hospitals in markets outside California. The inclusion of some experienced firms as new firms will reduce the observed difference between new firms and pre-existing firms. New hospitals are hospital facilities that did not exist prior to the firm entering the market, while pre-existing hospitals are hospitals that existed prior to entry but were operated by a different owner.

relationship between the log of firm size and years in the market. Chapter III identified that diversifying firms enter significantly larger than incumbent firms. The survival advantage of incumbent firms is realized primarily through entry size.

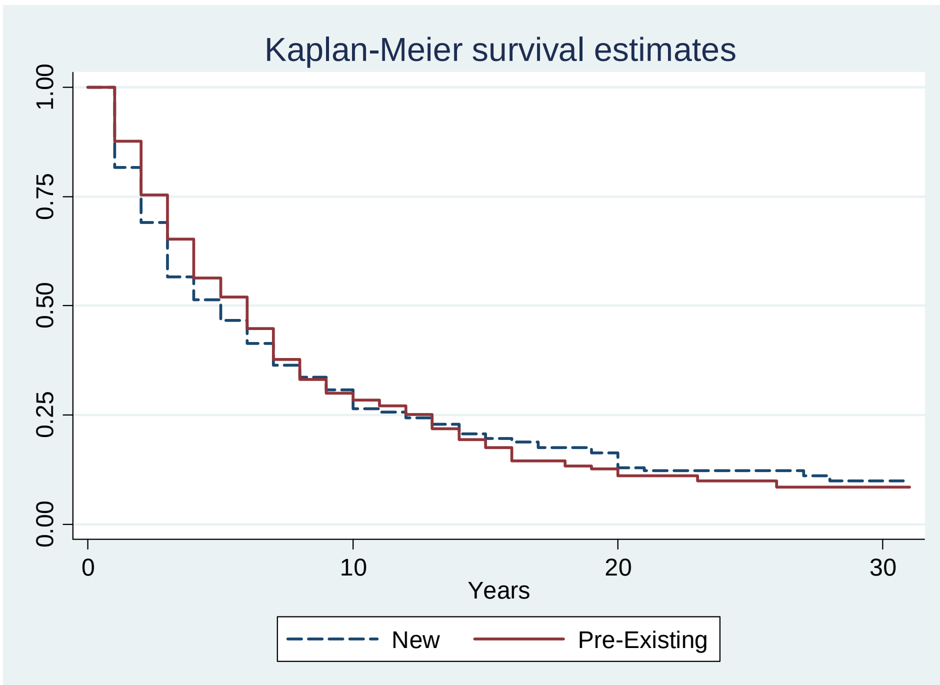

Figure 15. Survival Rate of New Firms

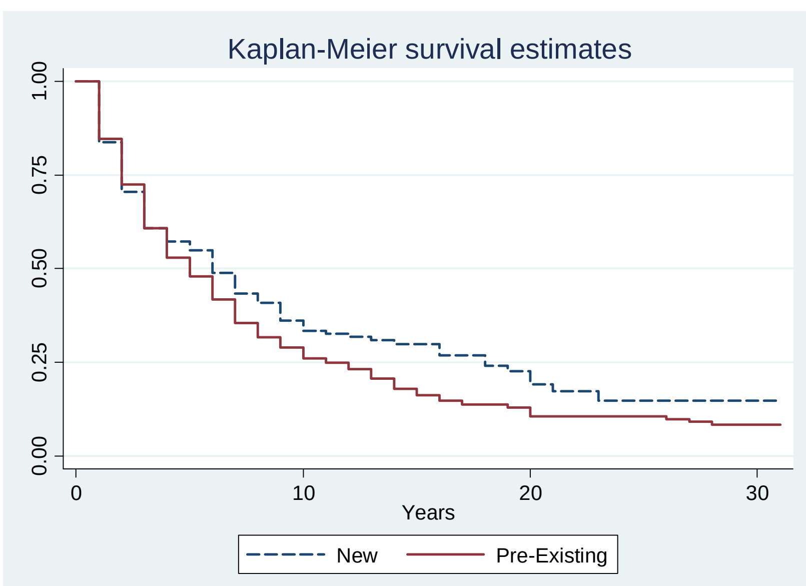

Figure 16. Survival Rate of New Hospitals

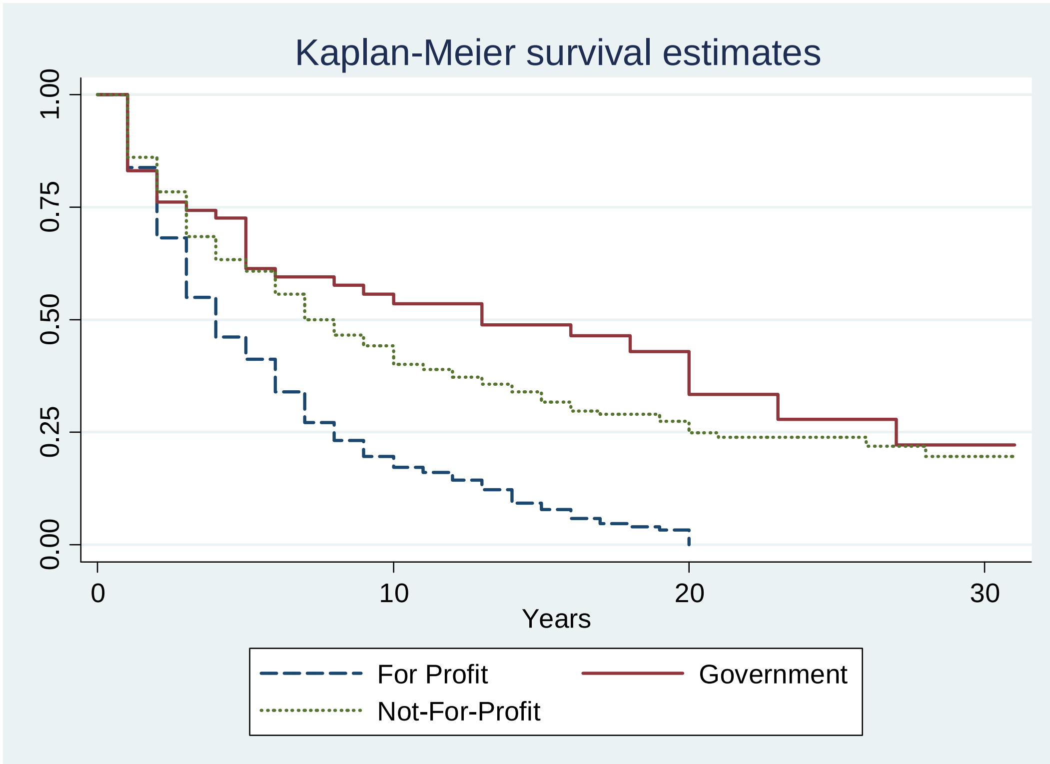

Figure 17. Survival Rate by Ownership Type

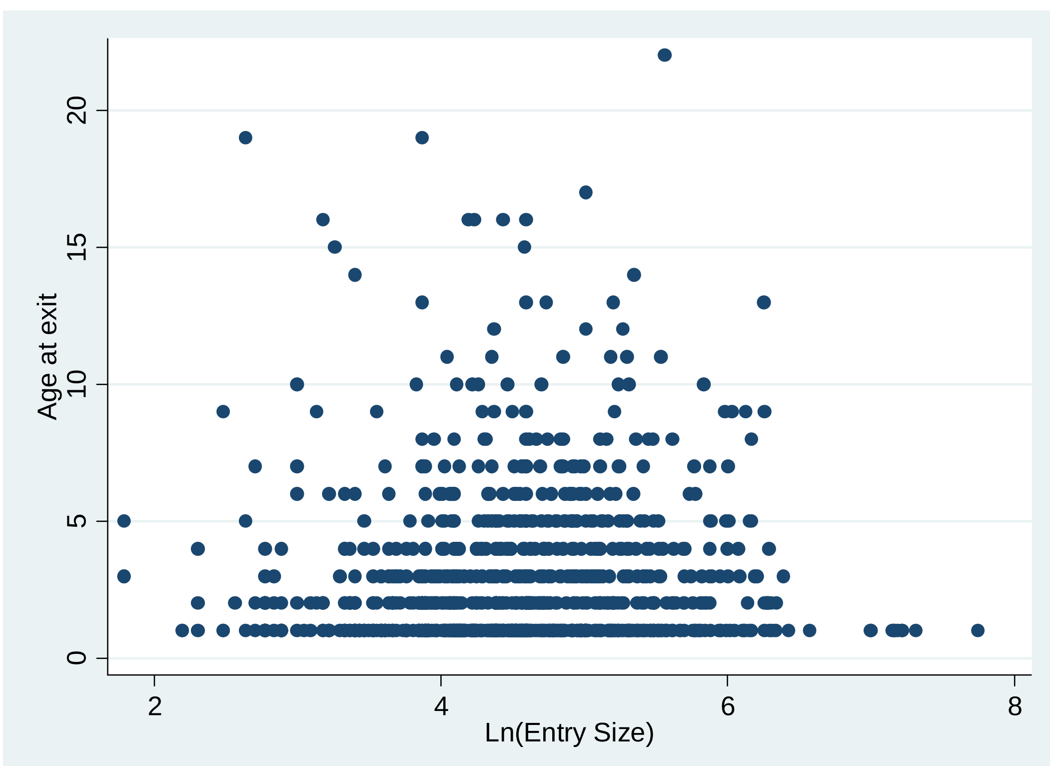

Figure 18. Survival and Entry Capacity

The model presented above suggests that initial capacity can provide a signal for efficient firms. Furthermore, because inexperienced firms have a larger positive bias for entry efficiency, the predictive power of capacity is smaller for new firms and new hospitals. New hospitals and new firms will exit at different rates than diversifying firms and preexisting hospitals. Firms that reduce capacity after entry overestimated efficiency and may ultimately exit while firms that increase capacity are likely to have under estimated efficiency and thus, are unlikely to exit.

Table 18 contains estimation results for Cox proportional hazard model of firm exit. The Cox proportional hazard model assumes that firms face a base line time dependent hazard function $\lambda_0(t)$ that is multiplicatively effecte by firm level attributes so that the hazard function follows the form $\lambda(t|X) = \lambda_0(t)e^{\beta^{`}X}$ where X is a vecter of firm attributes. I estimate this model using market exit as the dependent hazard variable. The hazard of exit is explained by firm and hospital experience, firm governance structure, entry capacity, and market demand.This model restricts the determinants of exit to firm entry characteristics. Across all specifications in table 18, larger entry is associated with higher survival rates. This is true even after conditioning on market size and firm experience. As predicted, the relationship between entry capacity and survival is smaller for less experienced firms and hospitals. The years of experience that a firm has when they enter a market is also a significant determinant of survival. Because the model conditions on firm capacity, which is a proxy for expected efficiency, the higher survival rate of more experienced entrants is an indication that experienced firms can more accurately predict their profitability.

System size, or the number of hospitals owned by a particular firm, is positively related to firm survival. This can be explained by either cost advantages due to multiplant economies or by system size being another proxy for firm efficiency.

New firms and new establishments have higher survival rates. The result is counter to most research thus far, however it is consistent with Mata et. al's work on firm experience and survival. Interacting the new firm dummy with profit status in columns 2 and 3 reveals that government hospitals receive the largest de novo survival advantage. There are a number of potential explanations for why new firms and new hospitals have higher survival rates. The increased survival rate of new firms and hospitals is likely due to unobserved variables. Health care technology is rapidly evolving. Investment in old hospitals represents investment in old technologies. Exit represents an acknowledgement of a mistake. Behavioral economics finds that error aversion, like other non-traditional behavioral patterns, diminishes with repetition. The survival advantage of new firms and hospitals represents an important direction for future research.

Under the logarithmic model entry size is only a significant predictor of survival for experienced firms (columns 1-3) and government hospitals (column 5). Survival increases more rapidly for new firms than it does for old firms. Firm age increases survival rates, however it increases survival rate faster for new firms than it does for old firms. These results are similar to the models prediction that experience in the market has a greater effect for less experienced firms. Not-for-profit and for profit firms both have lower survival rates and greater entry capacity advantage than government firms. Both observations are consistent with government, not-for-profit and for profit firms having progressively higher profit seeking motive.

Table 18: Cox Proportional Hazard of Market Exit

	(1)	(2)	(3)	(4)	(5)
New Firm	-0.202**	-1.939***	-1.767***	-1.641**	
	(0.0865)	(0.509)	(0.510)	(0.778)	
New Establishment	-0.335***	-1.956***	-1.588***	-1.812**	
	(0.103)	(0.549)	(0.554)	(0.849)	
New Firm*Non-profit		0.803***	0.812***	1.169*	
		(0.288)	(0.276)	(0.678)	
New Firm*For Profit		1.072***	0.960***	0.762	
		(0.278)	(0.267)	(0.665)	
New Est.*Non-profit		0.123	0.00349	0.342	
		(0.294)	(0.291)	(0.682)	
New Est.*For Profit		0.941***	0.835***	0.657	
		(0.259)	(0.256)	(0.661)	
Non-profit				-1.119	0.480**
				(1.022)	(0.196)
For Profit				-0.0265	1.088***
				(0.945)	(0.189)
Ln(Entry Size)	-0.208***	-0.335***	-0.332***	-0.410**	-0.124***
	(0.0452)	(0.0733)	(0.0747)	(0.185)	(0.0473)
Ln(Entry Size)*New Firm		0.160*	0.144	0.115	
		(0.0927)	(0.0932)	(0.0935)	
Ln(Entry Size)*New Est.		0.255**	0.193	0.242*	
		(0.119)	(0.118)	(0.127)	
Ln(Firm age at entry)	-0.131***	-0.113**	-0.0913*	-0.0669	-0.0166
	(0.0487)	(0.0514)	(0.0513)	(0.0518)	(0.0405)
Ln(System Size)		-0.0817**	-0.0685**	-0.0967***	-0.0779**
		(0.0344)	(0.0337)	(0.0344)	(0.0319)
Ln(Entry Size)*Non-Profit				0.176	
				(0.199)	
Ln(Entry Size)*For Profit				0.103	
				(0.185)	
Market controls	No	No	Yes	No	No
Observations	1,033	1,033	1,033	1,033	1,033

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 19: Logit Regression of Market Exit

	(1)	(2)	(3)	(4)	(5)
New Firm	0.0392	-2.313***	-2.242***	-1.849**	
	(0.0707)	(0.465)	(0.466)	(0.833)	
New Establishment	-0.496***	-2.614***	-2.669***	-1.903**	
	(0.102)	(0.583)	(0.583)	(0.944)	
New Firm*Non-profit		0.312	0.251	0.905	
		(0.199)	(0.199)	(0.707)	
New Firm*For Profit		0.665***	0.510***	0.369	
		(0.190)	(0.195)	(0.701)	
New Est.*Non-profit		0.336	0.273	0.584	
		(0.306)	(0.306)	(0.731)	
New Est.*For Profit		1.210***	1.154***	0.799	
		(0.280)	(0.281)	(0.726)	
Non-profit				1.160	2.354***
				(0.965)	(0.752)
For Profit				2.167**	2.983***
				(0.919)	(0.714)
Ln(Entry Size)	-0.206***	-0.403***	-0.462***	0.0253	0.391***
	(0.0428)	(0.0752)	(0.0782)	(0.164)	(0.143)
Ln(Entry Size)*New Firm		0.402***	0.413***	0.345***	
		(0.0924)	(0.0923)	(0.0941)	
Ln(Entry Size)*New Est.		0.327***	0.356***	0.224*	
		(0.114)	(0.113)	(0.120)	
Ln(Firm Age)		-0.152**	-0.149**	0.0361	-0.260***
		(0.0640)	(0.0653)	(0.0791)	(0.0395)
New Firm*Ln(Firm Age)		-0.268***	-0.279***	-0.433***	
		(0.0794)	(0.0801)	(0.0909)	
New Hospital*Ln(Firm Age)		0.00268	-0.0108	-0.103	
		(0.103)	(0.104)	(0.104)	
Ln(System Size)		-0.218***	-0.214***	-0.271***	-0.153***
		(0.0379)	(0.0380)	(0.0396)	(0.0318)
Ln(Entry Size)*Non-Profit				-0.393**	-0.470***
				(0.167)	(0.158)
Ln(Entry Size)*For Profit				-0.402**	-0.464***
				(0.159)	(0.151)
Market controls	No	No	Yes	No	Yes
Observations	7,895	7,895	7,895	7,895	7,895

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Two additional measures of entry size, entrant relative size and entrant relative size by governance structure, generate similar results. However, scaling relative size by governance structure weakens the magnitude and significance of both the governance dummies and the governance interaction terms. The models are estimated with relative size by redefining capacity as relative capacity, or the ratio of hospital capacity to average hospital capacity.

The results presented above are consistent across numerous robustness checks. The logit model of exit is robust to specifying a probit distribution. Chapter III indicates that hospital exit patterns changed after 1991. Restricting the data to post 1991 entry does not change the sign or weaken the significance of any of the key explanatory variables. Restricting the data to short term general hospitals also has little effect on the results.

The survival model presented in this chapter predicts that firms with greater uncertainty regarding productivity will enter relatively small and grow relatively fast. New firms, new establishments, younger firms and smaller firms are expected to have greater uncertainty regarding productivity. Table 20 presents estimation results for the determinants of capacity growth. New firms are the only category of firms that do not follow expected growth patterns.

Growth decreases with firm age. This is consistent with the idea that productivity beliefs become more certain with experience. The relationship between establishment age and growth was assessed both independently and in conjunction with firm age. In both cases establishment age does not significantly affect growth rates.

Exit Markets is a dummy variable that takes the value 1 in the year that firms exit markets. Firms that exit the market tend to have lower levels of growth. This is consistent with the prediction that firms which exit slowly revise productivity estimates down.

Table 20. Entrant Experience and Hospital Capacity Growth

New Firm	-0.033
	(0.016)**
New Establishment	0.064
	(0.017)***
Ln(Firm Age)	-0.046
	(0.009)***
Not-for-profit	0.046
	(0.008)***
For Profit	0.045
	(0.011)***
Entry Size/100	-0.005
	(0.002)**
Exits Market	-0.088
	(0.014)***
Constant	0.072
	(0.021)***
Multi-Hospital Firm	-0.052
	(0.016)***
County Demand Controls	Yes
R^2	0.03
N	6,390

Robust standard errors in parentheses
* p<0.1; ** p<0.05; *** p<0.01

Owner/facilities that enter as new hospitals are more likely to exit, and owner/facilities that enter as new owners are more likely to exit. The relationship between hospital experience and exit is statistically insignificant. Higher entry capacity reduces the likelihood of exit for firms with entry experience, but has no effect on new hospitals and a positive effect on new firms. Thus firms that enter without experience should enter small while firms that enter with experience should enter with larger capacity.

Conclusion

The hospital industry is unique from other industries in that it is a service industry with relatively large fixed facility costs and a broad mixture of governance structures. Because hospital facilities serve a relatively specialized function investment in hospital capacity is relatively sunk. This makes the initial capacity choice of a firm critical to firm survival. Consistent with other industries, hospitals that enter with larger capacities have lower hazards of exit. Capacity plays a much smaller roll for new firms and facilities. This is consistent with inexperienced firms making more errors with regards to optimal entry size.

Unlike previous research (Klepper [2002], Dunne et al. [2005] and Mata et al. [1995]) new hospitals and new firms have higher survival rates. Identifying the reason for this survival advantage could provide useful insight to the firm entry and exit decision. The greater risk associated with new entry they may result in a large wedge between the minimum expected productivity of experienced entrants and the minimum expected productivity of inexperienced entrants. This difference is not observable from entry capacity alone because the higher variance of expected productivity for inexperienced firms will also place downward pressure on entry capacity.

If inexperienced firms are in fact entering with conservative capacity but higher expected productivity they would have higher growth rates than experienced entrants. New hospitals, even after conditioning for demand characteristics, have higher growth rates than entrants purchasing established hospitals. However, new firms grow slower than diversifying firms. This indicates that market specific uncertainty plays a different role than firm specific uncertainty.

CHAPTER V

GOVERNANCE STRUCTURE IN THE HOSPITAL INDUSTRY

This dissertation has explored several major themes in relationship to governance structure in the hospital industry. I have introduced governance structure as a defining characteristic in the theory of the firm and the empirical analysis of firm behavior. A substantial and growing portion of US firms are organized under some form of not-for-profit governance structure. This sector of the economy has experienced higher employment and salary growth than the for profit sector between 2000 and 2010 [Roeger, Blackwood, and Pettijohn, 2012]. The growing diversity in the form of firm governance structure makes research regarding governance structure, and the not-for-profit distinction in particular, meaningful and relevant to firm owners, firm management, government policy makers and academics.

Chapter II develops a body of evidence identifying heterogeneous firm objectives. Firm objective plays a critical role in many decision making processes. Government treatment of firms in uncompetitive markets depends on firm objective. Market expectations and the investment and production decisions that depend on them are based on firm objectives. Firms that act according to welfare increasing objectives can be identified through their actions.

Not-for-profit hospital firms price goods with a significantly smaller markup over marginal cost than for profit firms. This is consistent with not-for-profit firms having objective functions with greater weight placed on social welfare. Religious based not-for-profit hospitals have even smaller markup ratios than corporate not-for-profits.

Chapter III identifies numerous patterns in entry, exit, and the evolution of the hospital industry. Entry and exit in the hospital industry follow patterns that are similar to those found in the manufacturing industry. However, there are a few key differences that identify a different underlying data generating process. First, facilities enter and exit at a significantly lower rate in the hospital industry. This is likely due to the maturity of the industry and the significant sunk costs of facility entry. Firms enter and exit specific markets at more comparable rates to manufacturing firms. However, not-for-profit and government firms enter and exit at progressively smaller rates than for profits, indicating a greater willingness to invest and remain in low profitability markets.

The entry and exit rates of hospitals, as well as relative size at entry and exit, are significantly different across pre-entry firm experience. Less experienced firms enter with smaller scale, especially when by constructing a new facility. One explanation, which is explored in Chapter IV, is that market and firm level uncertainty lead inexperienced firms to enter at smaller rates than experienced firms.

Chapter IV explores the relationship between hospital experiences, facility experience, and firm survival. The model developed extends Jovanovich's model of uncertain firm productivity to allow for heterogeneous post-entry beliefs. This extension results in firm's entering with different capacity, and with entry capacity having predictive power over firm survival.

Two empirical models of firm survival are estimated using the California hospital data. The results indicate that after accounting for hospital entry characteristics, new firms and new facilities have a higher rate of survival than experienced firms. Entry size is positively related to firm survival. This relationship is weak for firms with less entry experience. The relationship between entrant experience, entry size and firm survival is consistent with the theoretical model of heterogeneous firm entry beliefs.

This work identifies a number of important avenues for future research. The consolidation of the Californian hospital industry and the changing patterns of entry over the last 35 years points to a structural change in the market. Two important factors have been identified as a change in Medicare reimbursement policies and the development of managed care insurance providers. The Affordable Care Act of 2010 will introduce a third major structural break in the hospital industry. This dissertation identifies that governance structure will play a critical role in how this act affects the hospital industry.

The demographics of the California hospital market have evolved considerably over the study period. In addition California's regulatory oversight of hospital entry has diminished. One potential direction for future work is to identify how these changes have affected the structure of the hospital industry.

Finally, I have demonstrated that there are many significant differences in firm objectives and behaviors. One factor in these differences is the governance structure that the firm operates under. However I have also shown that firm behavior is heterogeneous within governance structures. For government policy to effectively address differences between firms, policy makers need a more accurate way to identify firm type. A fruitful area for future work will be to investigate how firms self-select into different governance structures and to investigate what drives differences between firms within the same governance structure.

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